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Effects of Railroad Deregulation on Grain Transportation

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EFFECTS OF RAILROAD DEREGULATION ON GRAIN TRANSPORTATION. By James M. MacDonald. Commodity Economics Division, Economic Research Service, U.S. Department of Agriculture. Technical Bulletin No. 1759.

ABSTRACT

Railroad deregulation helped reduce grain transport costs. Shippers now benefit from increased competition among railroads, and from reductions in rail costs, as railroads abandoned unprofitable branch lines, upgraded remaining lines, and restructured rates to provide incentives to shippers to use less costly methods. This report details how the early effects of rail deregulation changed grain transportation after Congress passed the Staggers Rail Act in 1980.

Keywords: Staggers Act, deregulation, railroads, grain transportation, rail rates.

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STAGGERS ACT SHOWN TO HELP REDUCE GRAIN RATES

Analysis of Waybill samples shows a reduction in rail grain rates since the passage of Staggers; the analysis separates the impact of declining export volume and increasing shipment size from the effects of deregulation.

Benefits. Rail deregulation has generally led to reduced grain transportation costs. Most shippers now benefit from increased competition among railroads, and from reductions in rail costs, as railroads abandoned unprofitable branch lines, upgraded remaining lines, and restructured rates so as to provide incentives to shippers to use less costly shipping methods. Transport costs also fell because of declining export grain demand in the 1980's, but the benefits of deregulation will remain after export markets recover. This report details how the early effects of rail deregulation have changed grain transportation.

The Staggers Rail Act, passed in 1980, has been the principal basis of regulatory reform. The act fundamentally altered the pricing system for rail commodities, expedited abandonment procedures, provided increased capital financing, and restricted the scope of remaining rate regulation. The Government's transportation policy, as stated in Title I of the Conference Committee Report, was, "henceforth, to allow, to the maximum extent possible, competition and the demand for services to establish reasonable rates for services."

Before and After. Under regulation, the rate structure in the Great Plains did not offer incentives to shippers to use unit trains or multiple-car shipments, which impose lower per bushel costs on the rail system. As a result, single-car shipments dominated the regulated transport network for Great Plains agriculture. However, during the 1970's, railroads and shippers in the Corn Belt moved to a lower cost system of unit trains on export corn movements in order to meet competitive pressures from the unregulated barge industry. The Staggers Act accelerated the change in rate structures in the Corn Belt and introduced the new structures in the Great Plains, resulting in a rapid spread of unit trains, multiple-car shipments, and modernized loading facilities.

Deregulated rail rates depend upon shipment size and distance, annual volume, and the extent of competition from barges or other railroads. Nearby barge competition has powerful effects on rail rates, and restrains rail market power throughout much of the Corn Belt. The presence of a competing railroad also has a noticeable effect on rail rates. Competition is weakest, and rail rates rise well above incremental costs in regions (generally, western parts of the Great Plains) that have only one or two railroads and are far from navigable rivers.

Results of Staggers. So far, the changes in rates and services have not fundamentally altered the typical methods of concentrating grain for shipment, or the typical patterns of grain flows. The report identifies the few cases of such shifts. Further changes are likely to occur slowly.

Regulatory reform did alter the process of setting rail rates. Where regulated rates were posted and set through a process of collective ratemaking, contemporary rates are likely to be confidential contract rates, negotiated between a particular railroad and shipper. A shipper's experience in contracting and ability to deliver large quantities of grain are important factors in ratemaking.

Rail deregulation has spurred the rationalization of the rail network and has provided incentives for innovative services and pricing. Railroads have been able to reduce costs, and are now more viable. However, with large fixed costs and intense competition (both intramodal and intermodal) on many routes, it remains to be seen whether railroads will be able to obtain competitive rates of return on investment.

STRUCTURE OF THE ARGUMENT

1. Rail regulation imposed severe financial pressure on railroads, and resulted in high cost and relatively inefficient operating performance.

2. Regulatory reform allowed for much greater railroad flexibility in ratesetting and service offerings, while restricting cooperative behavior among railroads.

3. Rates for hauling grain have fallen sharply since the 1980 Staggers Act, as shown in many studies using several different data sources.

4. But exports also fell, leading to reduced demand for railcars, and increases in unit train use led to reduced costs.

5. The present study argues that the Staggers Act introduced competition among railroads where intermodal competition was weak, and accelerated the adoption of unit trains and multiple-car shipments through pricing innovations.

6. The effects of Staggers are most pronounced in the Great Plains, because unregulated barge competition in the Corn Belt made regulation ineffective.

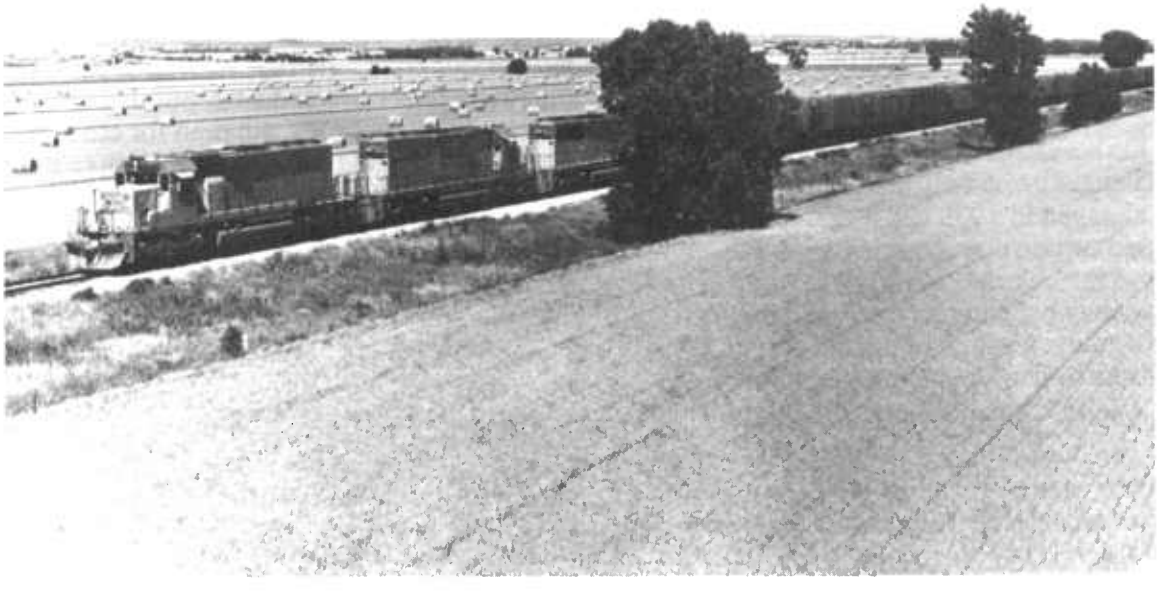

Photo courtesy of Union Pacific Railroad

IMPETUS TO REGULATORY REFORM

By the mid-1970's, railroads were under severe financial stress, and policymakers began to look to regulatory reform to improve the operating and financial performance of the system. The movement culminated in the 1980 passage of the Staggers Act.

Public policy concerns over the railroad industry have been closely linked to railroad financial health. Periodic financial crises affected many railroads during the industry's history, but chronic and widespread problems arose in the 1950's, beginning with such New England railroads as the New Haven and the Boston and Maine. During the late 1960's and early 1970's, several other eastern railroads went bankrupt; as the major eastern carrier, Penn Central, entered a financial collapse, the Federal Government took over much of the northeastern network and formed the Conrail system. The late 1970's brought bankruptcy to three midwestern railroads, the Katy, the Rock Island, and the Milwaukee Road. Financial problems were not limited to the weakest firms, but spanned the industry.

Reform. By the mid-1970's, policymakers began to look toward regulatory reform in transportation and in other industries, spurred by the political necessity to show action on policies that might reduce inflation. A series of academic studies investigated the inefficiencies of outmoded regulatory programs, and a sense of urgency was brought on by impending financial crisis in the rail industry.

Initial steps toward reform came with the Rail Revitalization and Regulatory Reform (4R) Act of 1976, which proposed improved pricing flexibility and eased restrictions on abandonments. However, the Interstate Commerce Commission (ICC) interpreted the act rather restrictively, and important regulatory changes came only after the composition of the ICC changed in 1979 (28,52).[1] The ICC then exempted certain commodities, such as produce, from rate regulation altogether, began to introduce confidential contract rates, and tried to accelerate the rationalization of the rail system by speeding abandonments and approving four major mergers.[2] The ICC's actions preceded the passage of the Staggers Act, and in some important respects, such as abandonment policy, the Staggers Act validated what the ICC had already done. The act also specified important new reforms and provided statutory congressional backing for the ICC's administrative actions. In turn, the ICC moved aggressively to implement the act in 1981.

Links to Grain. Railroads moved 40-50 percent of the grain arriving at U.S. ports for export and 60 percent of interstate grain for domestic destinations between 1976 and 1986 (3). Grain is an important bulk commodity for railroads, accounting for nearly 10 percent of rail tonnage. Railroads carry greater shares of wheat exports because corn production areas have excellent barge-shipping connections.

Some analysts had argued before passage of the Staggers Act that the effects of rail regulation varied across regions and commodities (10,18,48). Because grain production is widely dispersed across the country, we will see different responses to deregulation across production regions, if regulation really did have effects that varied by region.

Moreover, because of the wide variety of competitive conditions across grain production regions, we can investigate the explicit effects of competition on railroad behavior in the deregulated industry. Service quality, such as speed and reliability of service and susceptibility to damage, are less important for grain than for other commodities, and freight rates will more nearly reflect total costs of transportation for grains. Thus, analysis of grain transportation, while important itself, also provides useful evidence on the more general effects of rail deregulation.

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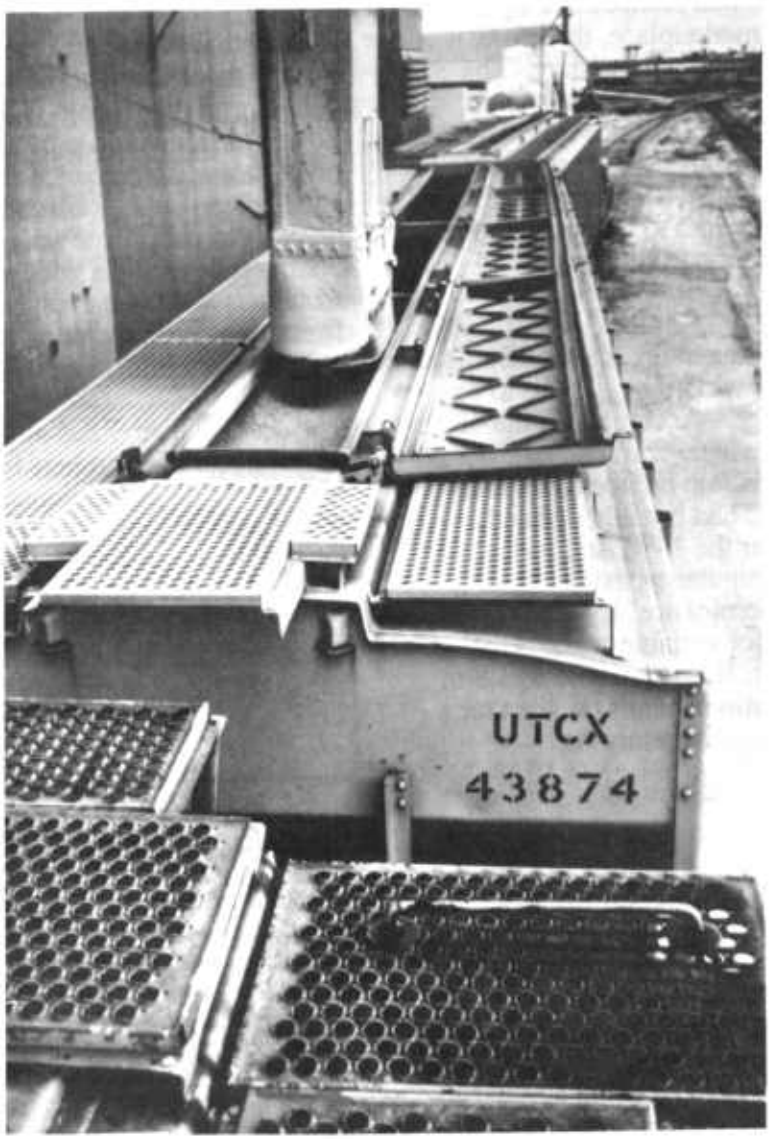
[1] Underlined numbers in parentheses cite sources listed in the Reference section.

[2] The mergers combined the Burlington Northern with the Frisco; the Chesapeake and Ohio with the Louisville and Nashville and the Seaboard Coast Lines; the Norfolk and Western with the Southern; and the Union Pacific with the Western Pacific and the Missouri Pacific.

Table 1--Financial health of the rail system, 1981

Financial classification	Return on book investment before taxes	Percent of system	
		Freight revenues	Route miles
		Percent	
Viable	Over 9	30.1	26.5
Marginally viable	7-9	22.5	24.0
Unlikely to be viable	4-7	26.2	25.7
Financial problems likely	0-4	21.2	23.7

Source: (28).



An Iowa grain co-op fills covered hopper car (photo courtesy of *Railway Age*).

GENERAL GOAL OF STAGGERS ACT

The Staggers Rail Act of 1980 aimed at improved performance of U.S. railroads by (1) allowing for more flexible ratesetting, (2) eliminating rate bureaus, and (3) permitting easier abandonment of lines.

The Staggers Act was in some ways a more dramatic change in Federal policy toward the railroads than the Interstate Commerce Act of 1887, according to Keeler. The 1887 Act codified certain principles that already existed in law, while the Staggers Act reversed important earlier policies (28).

Reliance on Marketplace. The Staggers Act was based on the premise that most transportation within the United States was competitive by 1980. Greater reliance on the marketplace, therefore, was essential for the health of the rail industry. The Staggers Act proposed to free railroads from a variety of common carrier obligations that resulted in unprofitable services or potentially profitable services at unprofitable rates. Railroads were to be allowed much greater freedom to restructure rates and services and to discontinue services by abandoning lines.

The simple principles of the Staggers Act disguised the complex methods by which the act was to be implemented. The Staggers Act amended the 4R Act to state that, except where a railroad had "market dominance," it would be free to set rates where it chose. The ICC had broadly defined "market dominance" after the 1976 Act, so the Staggers Act added the stipulation that a carrier does not have "market dominance" if its rates were below a certain multiple of variable costs. That multiple was set at 1.6 in 1980, and rose to 1.8 in 1984. After 1984, the ratio depends on whether a railroad is earning an adequate return on investment.

Major Changes. The Staggers Act specified major changes in the means of setting rates by allowing for much wider use of contract rates. Confidential contracts between a railroad and a shipper typically specify minimum sizes for single shipments and minimum volumes to be shipped over the length of the contract, and commit the carrier to provide a specified quantity of railcars and commit the shipper to specified loading speeds, all at what may be considerably below existing tariff rates. Contracts are likely to favor large shippers, because they offer lower rates for high-volume, predictable shipments, altering the longstanding regulatory focus on equalizing rates for all shippers of a commodity and for all ports receiving the commodity. While the Staggers Act offered increased flexibility for railroads to set rates, it also restricted the freedom to cooperate in setting rates by phasing out the right of railroads to coordinate ratesetting through rate bureaus. Only carriers actually participating in joint interline moves of freight can collectively set rates.[3] This right was once specifically protected in the Reed-Bulwinkle Act of 1948.

Elimination of rate bureaus combined with expansion of contract rates to restrict cooperative behavior in ratesetting. Without contract rates, posted tariffs would provide evidence of cheating on collusive agreements, and so serve to enforce such agreements. Railroads would find it more difficult to coordinate pricing, with confidential contracts covering a wide variety of services. Contracts and the ban on rate bureaus combined to foster competition among railroads in place of collusive pricing.

The act also liberalized procedures for abandonment of rail lines. Researchers had argued that restrictions on abandonments had contributed to the poor financial performance of railroads by saddling them with unprofitable services, which also diverted capital spending from more viable routes (34,52).[4] The abandonment provisions of the Staggers Act largely validated steps that the ICC began taking administratively in 1979.

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[3] Over time, mergers and consolidations, by enlarging and rationalizing rail systems, have greatly reduced the extent of interline moves. Today, only 7.5 percent of originated grain tonnage is interlined to another railroad before termination, according to data for Class I railroads in the ICC's Waybill statistics. That statistic in itself is a striking feature of the current environment compared with the 1960's and 1970's.

[4] Levin details the extent of light density lines in the systems of major railroads, and shows that financially troubled railroads were saddled with large systems of light density lines (34). Since 1974, Class I railroads have also divested about 8 percent of system mileage, largely branch lines and some alternate main lines, to short-line and regional railroads which have been able to negotiate more flexible work rules with rail labor. About 85 percent of the divested mileage was still in operation in 1986 (15).

GOAL OF STAGGERS ACT
Better Performance of U.S. Railroads

- Elimination of rate bureaus.
- Provide more freedom to restructure rates, including wider use of shipment specific contract rates.
- Permit easier abandonment of unprofitable lines.
- Retain rate regulation only where a rail carrier has market dominance.

EXPECTED RESULTS OF STAGGERS ACT -- HAD AGRICULTURE BEEN "SUBSIDIZED"?

If a result of Staggers has been the adjustment of grain freight rates, then we should be able to test whether or not pre-Staggers regulation had the effect of "subsidizing" agriculture.

There is no generally accepted theory of the goals and effects of rail regulation. Rather, a series of observations and partial theories existed, which produced divergent expectations about the effects of deregulation. External events unrelated to deregulation have affected the rail system in the 1980's, and their influence must be separated from that of the Staggers Act.

Theories of the goals and effects of rail regulation generally emphasized attempts at protecting particular parties. Analysts disagreed, however, on who was being protected. Three main views are represented in the opposite table.

One school argues that ICC rail regulation subsidized agriculture.[5] The theory draws its support from several pieces of evidence. First, analyses of average rates across broad classes of commodities seemed to show that rates on agricultural products were held to relatively low levels. Meyer, Peck, Stenason, and Zwick presented 1950's data showing that ratios of revenue to variable cost seemed to be relatively low for agricultural products (1.37) and relatively high for manufactured goods (1.84) (40). The difference was widely interpreted as evidence of a pricing structure designed to favor agriculture. Second, Congress required the ICC to consider relationships between agricultural freight rates and agricultural incomes in the 1925 Hoch-Smith resolution and in later transport legislation (17). Third, farm groups have often been the intended beneficiaries of government policy in other (nontransport) areas.

If rail regulation did serve to subsidize agriculture in general, then we should see sharp increases in freight rates under deregulation. Evidence summarized later in this report shows that such increases have not occurred. Instead, deregulation may have led to a restructuring of grain rates, with some rising and some falling.

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[5] According to Posner, "Value of service pricing may have persisted because it is a convenient method for subsidizing some shippers regardless of the elasticity of demands for all transportation. The favorable rates at which agricultural commodities continue to be transported seems a case in point. Considering the broad range of subsidies that farmers have managed to obtain for themselves, it is perhaps not surprising that they have obtained internal subsidies as well" (44,27). Friedlander and Spady says, "Thus over the past ninety years [i.e., since 1887] a rather symbiotic arrangement has evolved among small rural shippers, agricultural interests, railroads, and trucking firms, in which each has accepted certain costs in exchange for other benefits. The rural and agricultural interests have accepted higher freight rates and prices on manufactured commodities in exchange for relatively low rates on agricultural commodities in exchange for high rates on manufactured goods" (18,3).

EFFECTS OF
RAIL REGULATION BEFORE STAGGERS
Three Theories

- ICC rail regulation subsidized agriculture.

  If true, then agricultural freight rates should have generally risen after deregulation.

- ICC rail regulation allowed railroads to act collectively, as a cartel.

  If true, then rates should be stable after Staggers in the Corn Belt, where barge competition rendered a rail cartel ineffective.

  Plains States rates should fall, if Staggers rate reforms introduce more competitive behavior.

- ICC rail regulation caused rate equalization among shippers and among ports within a region, which reduced the incentive to introduce lower cost shipping methods, such as unit trains.

  If true, then expensive methods of shipping grain, such as single cars, should decline after deregulation -- and average rates should also decline.

EXPECTED RESULTS OF STAGGERS ACT -- MORE COMPETITION AND LESS RATE EQUALIZATION?

If Staggers has been successful, then we should be able to observe more competition between railroads, lower rates per unit of grain moved, and less "rate equalization" within regions.

New competition provides one possible source of changes in the rate structure. Several empirical studies argue that rail regulation was designed to protect a rail cartel against price cheating by members (27,30,36,49). The Staggers Act aimed to introduce competition among railroads by ending rate bureaus and encouraging the use of negotiated contract rates, and Levin showed that the expected effects of deregulation depend crucially on the extent of competition among railroads (32). Heaver and Nelson argued that confidential long-term contracting introduced competition into the Canadian rail duopoly (25).

Plains vs. Corn Belt. If deregulation introduced new competition among grain-hauling railroads, then the rate effects of such competition were likely to be strongest in the Plains States where railroads dominate the transport of grain. In Corn Belt States unregulated barges strongly compete with railroads, and a regulatory rail cartel is unlikely to have been effective. When the Meyer, Peck, Stenason, and Zwick data are disaggregated, they show that revenue-variable cost ratios for wheat were extremely high (2.23), but corn ratios were quite low (0.85). The disaggregated evidence casts doubt on the hypothesis that regulated rates generally protected agriculture.

Because the principal corn regions were subject to strong intermodal competition from barges (and from trucks on short-haul moves), while the more remote wheat-growing regions were dominated by rail transport, the evidence suggests that the regulated pricing system approximated that of a rail cartel (40,48). Fuller, Makus, and Taylor followed up on the suggestion provided by disaggregated data, and used 1970's data to calculate a mathematical programming model of maximum feasible unregulated rail rates for grain. (The maximum feasible rate is the highest rate consistent with the choice of a rail mode for grain movements out of a region. The model assumes a rail cartel and specified various levels of intermodal competition.) They found that 1972 rates closely approximated maximum feasible rates in most grain regions (19). Because of competition from barges, those rates were close to the incremental costs in the Corn Belt.

As one moved into the Plains regions and away from barges, rates rose well above incremental costs. Babcock found similar results in a second study (7). The studies suggest that deregulation would not lead to general rate increases, because regulated rates were close to the best that railroads could do. If the Staggers Act successfully introduced competition among railroads, then Plains rates were likely to fall, while Corn Belt rates would be unchanged.

Equalized Rates Within Regions. Regulated grain rates may have varied widely across producing regions but were generally equalized among shippers within regions. That is, the rate structure was designed to ensure that one port was not favored over another, nor one shipper over another, even if there were clear differences in the costs of serving particular shippers or ports (10). The policy seems to have derived from regulatory restrictions on personal price discrimination between shippers, with little regard for cost differences stemming from higher annual volumes and shipment sizes. Exceptions were allowed to meet intermodal competition, as from barges. This policy of rate equalization was not always feasible, especially when unregulated modes (such as barges) began to capture the traffic of shippers who were disadvantaged under the policy. For example, in the Corn Belt, unit trains, which granted preferential rates to large shippers, were introduced in the early 1970's and dominated rail traffic to export ports by the end of the decade. However, lower unit train rates were not introduced in Plains States until deregulation (24,29). Without pressure from barge traffic, rate equalization for small shippers was retained in the wheat-growing regions of the Plains.[6]

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[6] As corn exports surged in the 1970's, shipments to Gulf of Mexico ports, which could go by rail or barge, created a major corridor, attracting intense competition between railroads and barges. Railroads introduced unit trains, at volume rates, to compete with low-cost barges for gulf traffic.

Rate equalization generally favored small shippers, who were also favored by the common carrier obligation under which railroads were often required to provide service along branch lines that had long ceased to be profitable. The common carrier obligation was not wholly a creature of regulation, although enforced by the ICC, but was often imposed by State courts. Abandonment procedures were eased in the mid-1970's through provisions of the 4R Act and later ICC administrative procedures, which the 1980 Staggers Act essentially ratified. As a result, many branch lines (often serving agricultural regions) were abandoned or sold to small independent local and regional railroad companies.

Policies that favored rate equalization and restricted abandonments were not favored by railroads, and ICC furtherance of these policies implied that a simple producer-cartel model of ICC behavior may be mistaken. Rather, cartel pricing on potentially profitable routes provided a source of funds for cross subsidization of small shippers, branch lines, and passenger service.

Presumed Effects of Reform. Regulatory reform should lead to a change in rate structures, especially in regions like the Plains States where rate equalization was effective. Lower multiple-car and unit train rates should be offered. Larger elevators, with unit train loading facilities and rail contracts, should prosper. Trucks will perform more of the short-haul gathering functions as railroads concentrate on long multiple-car hauls. Small shippers in remote areas will be less likely to have direct rail service and will pay higher rates for it. Because barge competition made various regulatory policies less feasible by forcing efficient pricing, deregulation's effects should be more pronounced in regions where barge competition is weakest. I will consider the extent to which recent developments in rates support my interpretations.

ASSUMED DEGREE OF COMPETITION AMONG GRAIN-HAULING RAILROADS PRE-STAGGERS

- Plains States

  Montana, North Dakota, South Dakota, Nebraska, Colorado, Kansas, Oklahoma, Texas

  Little intermodal competition, because rail dominated the available modes, and rate bureaus restricted intramodal competition.

- Corn Belt States

  Iowa, Illinois, Indiana, Michigan, Minnesota, Missouri, Ohio

  Considerable intermodal competition, because of the presence of unregulated barge transportation.

TIMING OF DEREGULATION AND COINCIDENCE WITH OTHER MAJOR TRENDS

The record of rail rates shows rather clearly that rates fell in the years after Staggers was passed. But U.S. exports also fell dramatically in the same period, and carriers were converting to cheaper methods of operation such as unit trains. Can these trends be separated from deregulation itself?

Most empirical analyses set the beginning of deregulation in 1981, after the October 1980 passage of the Staggers Act legislation. This demarcation is useful but somewhat arbitrary. Some Staggers Act provisions were ambiguous, leading to uncertainty over which collective ratemaking activities were legal and which were not. Interpretation of the statute continued over time, and some issues, such as the definitions of market dominance and revenue adequacy, are still being decided. But, the spread of contract rates, the end of rate bureaus, and the widespread experimentation with rates nevertheless indicate that major changes soon followed passage of the Staggers Act.

Other steps toward regulatory reform preceded the act. The 4R Act specified important legislative changes in the treatment of abandonments and in ratesetting regulations. Keeler notes that the 4R Act only partially reformed ratesetting: it allowed some greater individual flexibility but retained rate bureaus and restricted contract rates. Those partial reforms were further limited by restrictive ICC interpretations (28,56). With changes in membership in 1979, the ICC began an aggressive move toward deregulation by exempting certain commodities from rate regulation, expediting abandonment proceedings, and expanding the use of contracting. The ICC decisions anticipated the direction in which later legislation would go in these important areas. Rail regulation changed fundamentally in October 1980 when the Staggers Act was passed, but because reforms also occurred before and after the act, we cannot always automatically use that month as the point when regulation shifts to deregulation.

Statistical analysis would be simpler if we could assert that deregulation caused events that occurred after 1980. However, two major events of the 1980's confound that hope and complicate the analysis.

Export Decline. First, grain exports dropped sharply in the 1980's (table 2). In 1985, grain exports were 20 percent below 1984 levels and over 30 percent below the 1979 peak. Fewer exports led to declines in demand for transportation to ports and exerted downward pressure on transportation rates. Export declines probably placed strong pressure on barge rates because the barge industry was highly dependent on bulk exports, and barges cannot be easily shifted to domestic uses. Railcars can be shifted to domestic routes, however, and domestic rail flows rose to offset the export losses. In short, railcar supply to export routes should be relatively elastic with respect to price, while barge supply should be relatively inelastic. As a result, rail rates probably declined along barge-sensitive routes, but elsewhere, the export decline likely did little to weaken rates.

Unit Trains. The second coincident effect was the rapid and widespread diffusion of unit trains and multiple-car shipments. These shipments impose lower per bushel costs on railroads but generate greater capital and inventory costs for shippers. Railroads must therefore offer lower rates to attract grain for unit trains. The resulting diffusion of larger shipment sizes probably reduced rates in the Plains States after passage of the Staggers Act.

Each event placed downward pressure on rail rates. Each effect may in turn result partly from deregulation, first because the Staggers Act may have made rail pricing more responsive to demand changes and second because the pricing flexibility introduced by Staggers may have accelerated the spread of larger shipment sizes.

ANALYTICAL PROBLEMS IN DISCERNING CLEAR EFFECT OF STAGGERS ACT

1. In the 5 years after Staggers, rail grain rates fell sharply in most areas of the country.
2. Was the fall in rates caused by Staggers?
   a. During the same period, U.S. exports of grain also fell, by over 30 percent.
   b. During the same period, shippers and railroads adopted multiple-car and unit train operations, which certainly reduced costs and perhaps rates.
3. In order to identify the effects of regulatory reform on rates, we must be able to control for the effects of export shifts and changing shipment sizes.

Table 2--U.S. grain exports

Year	All grain and soybeans	Major crops		
		Corn	Wheat	Soybeans
		Million metric tons		
1975	99.6	43.4	31.9	15.1
1976	94.8	42.8	25.9	15.4
1977	109.3	49.5	30.6	19.1
1978	116.7	54.2	32.5	20.1
1979	136.3	61.8	37.4	23.8
1980	134.6	59.8	41.2	19.7
1981	135.7	50.0	48.2	25.3
1982	122.8	47.5	41.1	24.6
1983	117.9	47.4	38.9	20.1
1984	113.9	46.7	38.8	16.3
1985	91.0	36.8	25.9	20.1

Source: (51).

DECREASED USE OF SINGLE-CAR GRAIN SHIPMENTS SINCE STAGGERS

Single-car transportation of grain shows clear and large declines over all destinations and all commodities for the period after Staggers. Regulatory reform may have contributed to this shift, but in any case the rate effects of shipment size shifts should be isolated from other effects of deregulation.

Table 3 details the trends in shipment sizes for five major crops during 1981-85 (because of the change in sample construction, the 1981 data refer to only the last 6 months of 1981). The data, drawn from the ICC rail Waybill file, are a stratified sample of all Waybills, with sampling probabilities ranging from 1 percent of some single-car movements to 50 percent of large unit trains. We cannot use the Waybill file before July 1981, because the earlier sample underestimated unit train movements.[7]

Table 3 shows the proportion of grain and soybean tonnage accounted for by single-car shipments. Shipments are separated into three destination categories. Major intermediate destinations include 23 points (e.g., Kansas City, MO; Minneapolis, MN, and Columbus, OH) which are principal inland destinations for grain shipped from country elevators. They are major origin points for interregional and export shipments and are often sites of major processing facilities. Export ports include 41 locations which are major transshipment points for exports, including ocean ports such as Norfolk, Houston, and Seattle, and some points on the Mexican border. Other domestic destinations are the residual. The data cover soybeans, wheat, corn, sorghum, and barley.

Single-car Decline. Single-car tonnage shares show clear and large declines over all destinations and all commodities. For example, single-car moves accounted for 95.3 percent of wheat tonnage flowing into major intermediate destinations in 1981, but fell steadily to 32.2 percent by 1985. Sorghum, produced primarily in Southern Plains wheat growing areas, shows a similar rate of decline. The single-car share of corn flows was less important in 1981, but also fell dramatically by 1985. Single-car moves retained a high, albeit falling, share only in barley. The typical shift for these "gathering moves" to intermediate destinations was from single-car movements to 3-, 5-, or 12-car multiples, with a small increase in 16-car and unit train movements.

Single-car movements should be less important for export shipments, because facilities for unit trains have long existed in export corridors. Yet, single-car movements have also shown sharp declines in their share of export tonnage. The small single-car share of corn export movements virtually disappeared, and the important single-car shares in wheat, sorghum, and soybeans plunged dramatically. Single-car movements dominated barley export tonnage in 1981, but accounted for less than a third in 1984, before increasing to half in 1985.

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[7] Waybill statistics for the 1970's were a 1-percent probability sample of all Waybills. The smaller sampling probability makes for less precise estimates of flows, but the sample also appears to have been biased. Specifically, 1970's data show far lower volumes of corn and coal movements, where unit trains predominated, than do the Department of Transportation's Freight Commodity Statistics. Hill, Leath, and Fuller reported that 1977 Waybill data seriously understate corn volumes (compared with 1977 Grain Flow Survey) on export corridors known to be dominated by unit trains (26). Wolfe documents the improvements in unit train coverage under the new sample (56).

Table 3--Percentage of grain tonnage arriving by single-car movement

Destination	1981	1982	1983	1984	1985
			Percent		
Major intermediate destinations:					
Wheat	95.3	80.1	69.4	42.1	32.2
Corn	30.2	21.6	16.5	10.6	11.3
Soybeans	89.9	48.9	29.2	19.8	20.4
Sorghum	93.5	85.4	82.8	49.7	30.8
Barley	100.0	97.0	89.6	91.5	75.7
Other domestic destinations:					
Wheat	65.3	43.9	30.3	25.9	19.7
Corn	38.4	22.5	16.8	13.7	11.2
Soybeans	57.7	32.3	17.1	13.1	16.3
Sorghum	77.2	67.9	58.5	33.5	22.3
Barley	91.0	91.0	78.8	72.1	68.4
Export ports and Mexican border:					
Wheat	32.7	14.9	7.6	4.6	9.2
Corn	11.2	4.0	1.3	1.5	1.4
Soybeans	35.7	8.5	2.7	3.0	1.6
Sorghum	32.3	14.3	10.0	6.7	4.3
Barley	92.8	66.5	31.4	29.3	52.8

1981 data cover only second half of year.

Source: Calculations based on ICC rail Waybill file.

INCREASED USE OF MULTIPLE-CAR AND UNIT TRAIN GRAIN SHIPMENTS SINCE STAGGERS

Unit train dominance of export grain shipments increased after Staggers, because of evident cost savings to shippers.

Table 4 shows that unit trains dominated the export movement of corn in each year, but with no clear trend over time. Wheat and sorghum movements increased sharply through 1984, but declining export volumes led to declines in unit train use by 1985.

The unusual shock to exports in 1985 probably slowed the shift to larger shipment sizes on export routes, because fewer shippers committed grain movements large enough to justify unit train movements. To test that hypothesis, I investigated the probability that a unit train would be used for a wheat shipment in 1984 and 1985. The regression yielded the results shown opposite. Because the dependent variable was dichotomous, I used the logit regression technique. Predicted values are logarithms of the odds ration [p/(1-p)], where p is the probability that a unit train will be used for a shipment. All data are taken from the Waybill file, specified in natural logarithms (except for the year dummy), and weighted by the inverse of the sampling probability. The choice of a unit train is strongly influenced by distance and annual volume, and 1985 appears to have no significant difference from 1984, once one accounts for distance and volume.

Falling 1985 volumes account for the decline in unit train use. When we solve for p using estimated coefficients and typical export movements from Kansas inland terminals (600 miles and an annual volume of 240,000 tons), the predicted probability that a 1984 shipment will be in a unit train is 58 percent (for 1985, 57 percent). For a volume of 160,000 tons (consistent with the export decline in table 2), the probability falls to 45 percent. The 1984-85 decline in unit train use seems to result from the decline in volume on export routes and not from any structural shift away from unit trains.

The logit analysis also shows the importance of distance to the choice of shipment size. Unit trains dominate the 1,200-mile grain hauls to Seattle from Montana and the Dakotas, but 12- and 26-car movements dominate the shorter routes from eastern Washington to Seattle and from the Dakotas to Duluth. Shorter hauls require less intermediate switching, which attenuates the principal cost advantage of the unit trains through service.

Large shipment sizes still obtain important rate reductions on gathering moves. The size of the reduction can be estimated by using 1985 Waybill data on wheat movements to major intermediate points (The gathering system is most important for wheat). I estimated the regression relationship shown opposite. At a distance of 200 miles (typical for these gathering hauls), estimated 3-car (300 tons) rates are 5.5 percent below single-car rates, while 12-car rates are 12.2 percent lower.

Local train with loaded cars which will be gathered into unit trains (photo courtesy of Briggs Business Communication).

Table 4--Percentage of tonnage arriving at export ports by unit trains, five major grains

Crop	1981	1982	1983	1984	1985
			Percent		
Wheat	27.7	36.9	48.9	61.2	50.0
Corn	81.4	91.2	82.8	80.5	85.5
Soybeans	45.4	68.5	74.5	65.6	64.2
Sorghum	35.9	37.7	25.3	51.2	49.6
Barley	0	7.9	9.3	9.4	1.2

Unit trains are defined as shipments of at least 50 cars.
1981 data cover only second half of year.

Source: Calculations based on ICC rail Waybill file.

UNIT TRAIN LOGIT REGRESSION EQUATION AND RESULTS

UNIT = -35.97 + 3.094 MILES + 1.333 VOLUME -.0060 Y85

t-statistic: 27.48 22.42 22.59 0.05

where UNIT = 1 for a unit train shipment

MILES = Natural log of trip distance

VOLUME = Natural log of annual grain tonnage on the route

Y85 = Dummy variable for 1985

Choice of unit train is strongly influenced by distance and volume, and volume changes alone can account for the 1985 decline in unit train use.

GATHERING SHIPMENT RATE REGRESSION RESULTS

RTM = 5.275 - 0.611 MILES - 0.052 TONS

$R^2 = .74$

t-statistic: 92.16 82.13 6.62

where RTM = Revenue per ton-mile

MILES = Natural log of distance between origin and destination

TONS = Natural log of tons in shipment

Rates decline with distance and shipment size.

INTERREGIONAL EFFECTS OF CHANGES IN UNIT TRAIN USE

Some modest changes in physical methods of distribution have begun to occur in the wake of recent relative price changes.

In the Southern Great Plains States (Oklahoma, Kansas, Texas, Colorado), wheat has traditionally moved from country origins to major inland terminals, such as Hutchinson, KS, or Enid, OK, before being shipped on to the gulf coast for export or processed into flour and shipped to domestic locations. That traditional pattern has mostly held in the deregulatory period. Wheat moves in three- or five-car shipments (rather than single-car moves) into inland terminals, and is more likely now to be shipped from there in a unit train.

One exception to the traditional pattern has developed. The Waybill data showed that shippers in northwestern Kansas and nearby shippers in northeastern Colorado and southwestern Nebraska can ship directly to the gulf from unit train facilities in western Kansas (Colby, Mingo, Bird City, and St. Francis), bypassing the inland terminals in central and eastern Kansas.

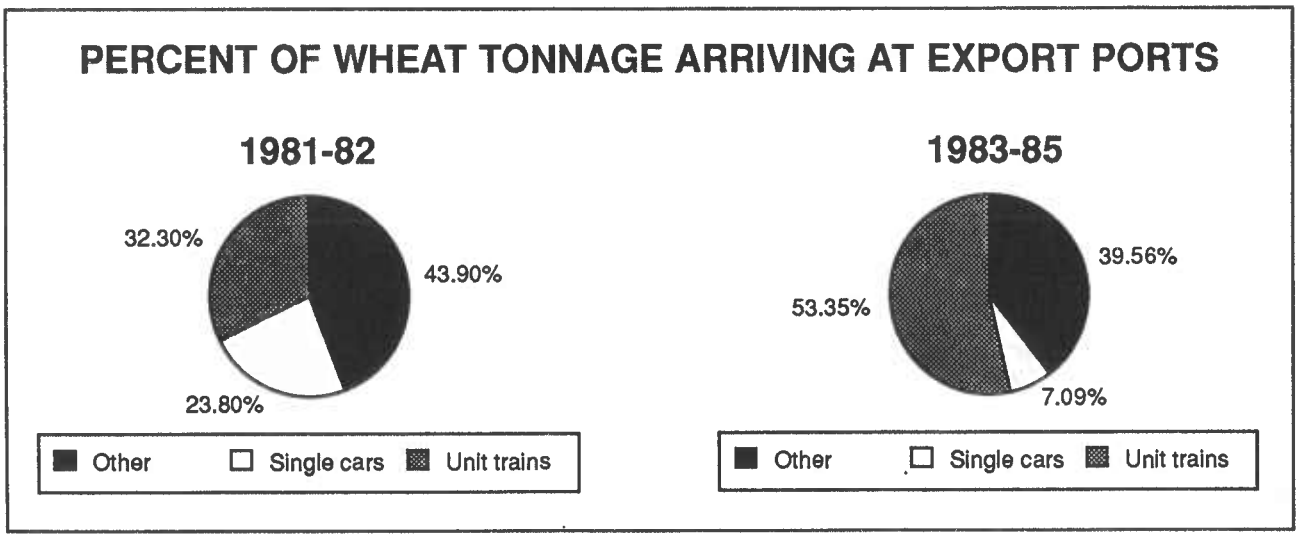
Kansas. The shift has several clear implications for producers and elevator operators in northwestern Kansas (13). Lower cost transportation to the gulf should increase net prices to producers (most of the region's wheat is exported). Producers may be able to ship to other outlets because Pacific Coast moves would be feasible for unit trains originating in the region. Local elevators that were not upgraded to handle unit trains would be under severe competitive pressure. Some might evolve into satellite storage for the larger regional elevators, with linkage by truck. In the long run, some elevators would close, while other remaining facilities would continue to provide storage and processing services, merchandising area grain to inland terminals in central and eastern Kansas. Existing inland terminals will also see declines in volume, which will most likely be met through postponed or canceled additions to capacity. Chow, Babcock, and Sorenson estimate that the net effect of the northwestern Kansas shift to direct shipment will be to reduce total system costs of transportation and storage in the region by about 10 percent, compared with continued transshipment via inland terminals (13). Their analysis reveals why the shift first occurred in this part of the Southern Plains. Northwestern Kansas is relatively far from the inland terminals of central and eastern Kansas. Direct shipment to the gulf reduces costs by more in northwest Kansas than it would from other country points (in Kansas, Texas, or Oklahoma) that are closer to inland terminals. At present, we cannot say whether other producing regions will begin to ship direct and bypass the inland terminals.

Rail deregulation may have led to some important changes in relative transportation costs. Because of the shift to multiple-car and unit train service, Plains State transport costs have fallen (caught up to be precise) relative to Corn Belt costs. With more interrail competition in the Southern Plains, shipper costs there may have fallen relative to those in the Northern Plains.

Feed Grains to Northeast. Changes in relative transportation costs may eventually lead to changes in the location of production facilities. For example, changes in regional rail transport costs for feed grains may spur more poultry production in the Northeast. During the 1950's and 1960's, poultry production shifted to the Southeast. Climate and relative input costs played important roles in the shift. However, relative feed transport costs shifted, also favoring the Southeast, as barge competition in the region offered lower rates, forcing railroads to also lower rates and introduce larger cars and multiple-car shipments. Since rail deregulation, some evidence indicates that relative transport costs to the Northeast have fallen (45). The Waybill files show that shipment sizes on domestic corn and soybean moves have increased in all eastern regions, especially to New York State. Twenty-six-car moves to central New York were initiated in 1983-84 (up from one- and three-car moves), and unit trains began routing to Albany. Albany is an export port, and also serves the surrounding region with truck and rail transshipments. Finally, plans for the State's first modern poultry-processing facility were announced in 1987.

In summary, we see a major shift from single-car shipments of all grains between 1981 and 1985, as shippers shifted to multiple-car shipments in many corridors (table 3). We also see a movement toward greater use of unit trains, especially for wheat exports (table 4). The pattern of shifts is consistent with a theory of rail regulation that

emphasizes rate equalization. Rate equalization was feasible in the Plains States wheat regions, far from barge competition. Unit trains were already in widespread use in corn regions, where rate equalization was less feasible under regulation because of competition from unregulated barges. Unit trains did not spread rapidly in wheat areas until deregulation.



SOURCES OF RATE DATA

Three alternative sources of rate data are available. Each has separate advantages and disadvantages; taken together their strengths complement one another and mitigate the weaknesses.

Because of widespread use of confidential contract rates within the industry since passage of the Staggers Act, the collection of useful rate data has become difficult. Analysts rarely have access to the terms of specific contracts.

Three alternatives are available: publicly quoted tariff rates, origin-destination grain price spreads, and Waybill data. Publicly quoted tariff rates do not necessarily reflect trends in contract rates, and we sometimes cannot be sure that any traffic is moving under the quoted tariff rate. Attention has focused on a second, indirect, method of rate estimation, the spread between elevator grain prices at export ports (such as Houston) and at inland origin points. The price spread should reflect the costs of transportation, storage, and other services, as well as the pressures of local commodity supply (increases reduce local prices and raise spreads) and export demand (increases raise export prices and spreads). If we can control for other factors, movements in margins should reflect movements in transportation rates. Price spreads tend to be weak in the cross-section dimension (available data cover a small number of corridors) but strong in the time series dimension (on corridors with data, the information tends to be detailed). Analysts have had some success in using margins lately, and I will review several of their efforts.

Nature of Waybill Data. The third alternative is the rate information in the ICC Waybill statistics. Before mid-1981, the Waybill file appeared to understate unit train movements of grain, which, in that period, were primarily corn movements (26). Since introduction of the new sampling procedure, the Waybill file has become a much more inclusive sample of grain rail movements.

The Waybill file is the only source that shows actual shipment sizes, and one can use it to measure commodity flows between regions. Rates derived from the Waybill observations should reflect base contract rates. That is, reporting railroads enter the expected revenue from a move. Revenue from shipments moving under tariff rates should be based on the tariff. Revenue from traffic moving under contract should reflect a base rate. Contracts usually specify a variety of commitments on either side, such as minimum volumes to be shipped over the life of the contract, loading speeds for shippers, and equipment commitments. Failure to meet the terms may result in later charges to the shipper or the carrier. These charges will not be reflected in Waybill documents. Some contracts will specify incentive clauses in which the rate depends upon total volume over the life of the contract (29). Waybill rates will not reflect such later volume-related discounts.

The U.S. Department of Agriculture's (USDA) Office of Transportation examined Kansas wheat contracts in 1985, and found that 42 percent of the contracts had provisions for refunds or allowances and virtually all contracts on some export routes had such provisions. The actual freight rate may fall as much as 25 percent below the contract rate, if refunds are granted. Because contract rates cover only a fraction of total shipments, and only a fraction of contracts offer large refunds, the rates with large realized refund provisions are not likely to have an important impact on estimated average rates in the aggregate. Some rate levels may be overestimated, however, causing rate declines to be underestimated in corridors with especially wide use of contract rates.

Drawbacks. Wolfe asserts that Waybill rates generally understate true declines in rates, based on two studies (56). He cites a USDA study that found a 33.7-percent decline in rates on 14 export corridors from Kansas to Texas during 1980-84, while Waybill data for the same period showed a 31.9-percent decline on all sample movements between Kansas and Texas or Louisiana (29). It's hard to see how this close correspondence, covering samples that are not identical, could support a criticism of Waybill data. Wolfe further cites the Association of American Railroads (AAR) findings of an 18.5-percent decline (in 1980-84) in grain rates from major country origins, and compares this with an average 13.2-percent decline on all Waybill grain movements in 1980-84 (4). The AAR sample consists of large shippers on heavily traveled routes, and thus overrepresents those routes with the largest rate declines. Waybill data clearly show the same magnitudes of change as other studies which use different samples. In short, I believe that Wolfe's calculations support the use of Waybill data.

With the change in sample construction, the Waybill file does have one serious drawback: Much greater confidence can be attached to the recent file than to earlier data. The file is most useful in ascertaining what has happened since passage of the Staggers Act, and is much less useful for pre-Staggers analysis. Consequently, while the Waybill sample is rich in the cross-section dimension (a large number of origin-destination pairs and specific shipment characteristics), it is relatively weak in the time-series dimension.

SOURCES OF RATE DATA

- Publicly quoted tariff rates.

  These do not reflect contract rates, which are usually much lower.

- Origin-destination grain price spreads.

  These reflect contract rates but also include other factors such as storage costs and demand fluctuations whose influences must be separated. They have a good time dimension, but do not account for changes in shipment size.

- Waybill samples.

  These have poor unit train coverage before 1981, when a new sampling procedure was begun. Waybills show shipment sizes as well as rate, and will reflect broad features of contract rates. Finally, Waybill data can be used to estimate corridor flows and to measure the concentration of rail services in a region.

"PRICE SPREADS" IN THE GREAT PLAINS SHOW A DECLINING TREND IN 1981-85

Corn Belt price spreads were quite sensitive to barge rates, but show no change in trend after Staggers.

Three recent studies employed time-series data on price spreads on export corridors to investigate changes in spreads after passage of Staggers. The studies differ in region, commodity, and statistical specification but provide some interesting and consistent results.

Kansas Wheat. The first, reported in several analyses of trends in transportation rates for Kansas wheat by Orlo Sorenson and others (8,29,48), reports that price spreads (and tariff rates) between 14 Kansas points and gulf export locations declined 30-40 percent in the 4 years after passage of Staggers. Price spreads had risen by an average 35 percent in the 4 years preceding Staggers. The Sorenson group's analyses also provide a brief history of rate initiatives in the period, showing that Kansas railroads generally cut tariff rates after the Staggers Act, and replaced the single-car tariff system with a new structure offering large reductions per bushel for multiple-car and unit train shipments.

The Kansas study covered an important commodity in an important grain-shipping State, and I rely on several findings in this paper. The statistical analysis of price trends, however, does not address associated developments, such as the spread of multiple-car and unit train shipments or the decline in export demand for U.S. grains in the 1980's, which could act to reduce spread and rail rates.

The timing of rate innovations suggests that the secular decline in wheat rates and price spreads was not initiated by declining export volume, although export volumes probably affected the continuing rate decline. New lower gathering and single-car rates were introduced on Kansas railroads in May and June of 1981, and the shift to multiple-car rate structure (25-car rates applied to 5-car minimum originations at local origins and 25 cars at collection points) was in place by early 1981. Large declines in price spreads and tariff rate at Kansas elevators occurred throughout 1981 and 1982 (29). Wheat exports peaked in 1981 at 48.2 million metric tons, when rates and spreads began their decline. Wheat exports in 1982, although 15 percent below the 1981 peak, approximated the 1980 volume, which was the previous peak (see table 2).

Kansas/Texas Wheat, Corn Belt Corn. Fuller and others examined several external influences in a regression analysis of trends in price spreads for rail movements to the gulf, using 1976-85 data on wheat (nine Kansas and three Texas regions) and corn (three Illinois, nine Indiana, and six Iowa regions) (20). Both export volume and local commodity production had statistically significant positive effects on price spreads, but the export demand coefficient was too small to account for the large decline in wheat spreads after passage of Staggers. The data do show sharp declines in rail tariff rates and spreads in several corridors in 1981, immediately after passage of Staggers and before the decline in wheat exports, results consistent with the Sorenson data and interpretations referred to earlier. Several factor price variables also had statistically significant effects, and in the corn equation, barge rates had a large, positive, and statistically significant effect on price spreads and rail rates (barges are rarely a viable alternative in wheat regions).

The authors also fitted pre- and post-Staggers trend terms to their data. Their wheat trends were close to the Sorenson group's results: after rising throughout the pre-Staggers period, spreads declined sharply in the 5 years after passage. The corn data showed a contrasting pattern. Spreads declined slowly but steadily in the pre-Staggers period and continued that trend after passage. No statistically significant change affected the corn trend after deregulation. Corn rates on routes served by barges fell steeply after deregulation, but the analysis ascribes that decline to falling barge rates rather than to a post-Staggers rate trend. Barge rates had no statistically significant effect on wheat price spreads.

Nebraska Corn, Soybeans. The difference in trends may be region-specific or commodity-specific. The results of Adam and Anderson suggest that regional factors were probably dominant (1). They investigated trends in corn and soybean price spreads for a sample of Nebraska elevators (the spread distinguished between the country elevator bid price and the Chicago futures price for the nearest month) during September 1978-August 1984. They entered measures of local

supply and demand and alternative transportation options in their regression models. Nebraska spreads were lower (bid prices were higher, relative to the Chicago price) in the post-Staggers period by large and statistically significant amounts.

In summary, price spreads in the Plains States reversed their trend and fell sharply after passage of Staggers, and shifts in export demand could not statistically account for the shift. No such shift occurred in the Corn Belt.

RESULTS OF PRICE SPREAD STUDIES

- Sorenson and others, Kansas wheat (48).

  -- *Implied rates up by 35 percent in 4 years before Staggers.*
  -- *Implied rates down by 30-40 percent in 4 years after Staggers.*
  -- *Is the shift due to Staggers or to coincident influences?*

- Fuller and others, Kansas/Texas wheat, Illinois/Indiana/Iowa corn (20).

  -- *Same pattern in wheat as Sorenson.*
  -- *Export demand coefficient not large enough to explain the decline in wheat rates.*
  -- *Barge rates had no impact on wheat , strong effect on corn.*
  -- *In corn, steady decline in rates pre-Staggers, continued decline after.*

- Adam and Anderson, Nebraska corn, soybeans (1).

  -- *Implied rates for each commodity down significantly after Staggers.*

- There appears to be a strong Staggers effect in the Great Plains, but not in the Corn Belt.

TARIFF RATE TRENDS FELL AFTER STAGGERS

Tariff rates declined in the Great Plains, and size-related discounts were introduced.

Restructurings changed Plains States tariff rates in the early 1980's (14,21,22). The Burlington Northern and the Soo Line railroads introduced multiple-car rate structures on movements out of Montana and the Dakotas to the Pacific Northwest and to Minneapolis and Duluth during December 1980-June 1981. The new structure offered lower rates for larger shipment sizes and replaced a rate structure that offered no discounts for size. Over the next 12 months railroads experimented with the tariff rate structure, reducing unit train rates to the Northwest and widening the spread between single-car and unit train rates. Contract rates occasionally fell well below tariff rates, increasing local bid prices relative to export prices (narrowing spreads) and attracting grain to Pacific ports from more distant parts of the Northern Plains (43).

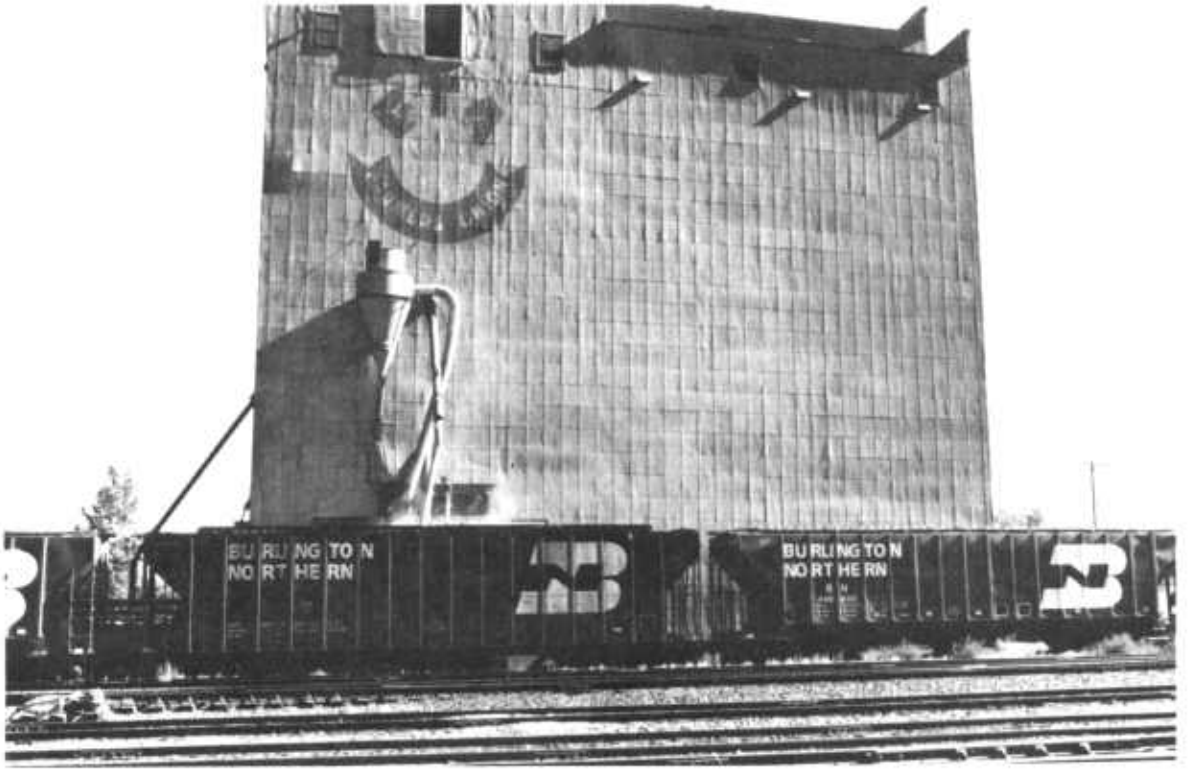
The broad direction of Northern Plains tariff rates after passage of Staggers appeared to be consistent with patterns observed in the Southern Plains. Hauser calculates that pre-Staggers truck rates to Duluth often were competitive with single-car rail rates on movements from the upper Great Plains (Montana, North Dakota, and South Dakota) (24). The post-Staggers introduction of multiple-car and unit train tariff rates gave rail a decided advantage.

Tariff rates in Kansas, Nebraska, and Colorado declined by an average 34.5 percent between 1981 and 1986 (14). The declines were widespread: export and domestic movements fell comparably, and rate declines on individual routes ranged from 17 percent to 44 percent, with most in the 30-40 percent range. Tariff rates on the 14 Kansas-gulf routes in the Sorenson group's studies declined by 33.7 percent, while price spreads fell by 35 percent (48). Part of the tariff rates shift seems to be related to the introduction of lower multiple-car and unit train rates.

CHANGES IN TARIFF RATES, 1981-86

• Plains to Pacific.	Previous rate structure, which had no discount for size of shipment, is replaced by a widening spread between single-car and unit train rates.
• Plains to Duluth.	Previous single-car rates comparable to truck are supplemented by lower multiple-car and unit train rates giving rail a decided advantage.
• Plains to Gulf.	Kansas-gulf tariff rates declined by over 30 percent.

Tariff rate evidence supports the price spread data, and provides a documentary history of the initial experimentation with size-related rates in the Plains.



A unit grain train fills up (photo courtesy of *Railway Age*) .

NATURE OF WAYBILL SAMPLE AND SELECTION OF DATA FOR STAGGERS ANALYSIS

A set of over 10,000 observations on corn and wheat from the Waybill sample for 1981 to 1985 forms the main source of empirical data in this study.

Waybill data give a wide geographic overview of rate trends since Staggers, allowing easy assessment of the rate effects of the introduction of larger cars (the replacement of 60- and 70-ton-capacity boxcars with 100-ton covered hoppers was completed in the early 1980's) and multiple-car shipments. The Waybill data also permit a closer look at regional differences in rate movements.

Recall, however, the Waybill file's principal drawback: the stratified sample was introduced in only mid-1981. Consequently, when we look at rate trends in 1981-85, we are looking at rate shifts in 1982, 1983, 1984, and 1985 relative to prevailing rates in the second half of 1981. We know from the previous section that rates in 1981 had declined, sometimes sharply, since 1980. The Waybill analyses should, therefore, understate the complete post-Staggers change in rates. The analyses can provide, however, valuable evidence on the sources of post-Staggers rate developments.

The regression model is described in the next section. The data set consists of all Waybill file rail movements of wheat and corn from major producing States to export ports (and points on the Mexican border) during July 1981-December 1985. There were 7,802 wheat observations and 3,363 corn observations.

Corn export volumes usually exceeded wheat volumes (see table 2). The sample had more wheat observations because shipment sizes for corn were typically larger than for wheat and because barges accounted for a larger share of export corn movements.

Recall that the data base was assembled using a stratified sampling procedure. To make the regression representative of the universe, I weighted all observations by the reciprocal of the sampling probability.

The Waybill data run through 1985. Because of the sharp drop in grain exports, 1985 may be a misleading terminal year for our analysis. I also ran regressions with 1985 observations deleted, and with separate dummy intercepts for years, instead of a continuous time trend.

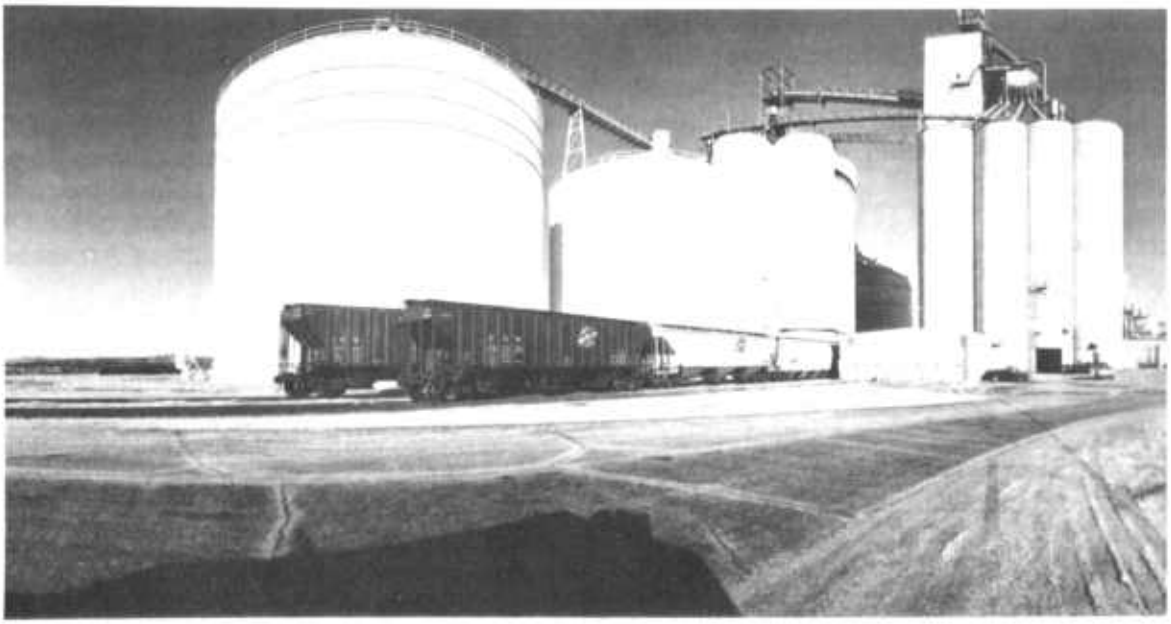
WAYBILL DATA USED IN STAGGERS ANALYSIS

Period. July 1981 (which marks the introduction of a valid, stratified sample) to December 1985.

The "rate trend for 1981 to 1985" is thus a measure of the shifts in 1982, 1983, 1984, and 1985 compared with the last half of 1981. This choice of period gives the analysis a conservative bias, because the Staggers Act was actually passed in October 1980, and tariff rate declines began before July 1981.

Data Set. Wheat observations: 7,802.
Corn observations: 3,363.

The set is of all movements of wheat and corn from major producing States to export ports and the Mexican border. Total corn exports are greater than wheat but corn shipment sizes are larger than wheat.



Grain hoppers placed at an Iowa co-op (photo courtesy of Chicago and Northwestern Transportation Company).

DESIGN OF REGRESSION EQUATION FOR WAYBILL SAMPLE ANALYSIS

A regression model was designed to analyze the Waybill sample of grain rates, so that important influences such as shipment size and competition could be isolated.

The variables are designed to capture the principal factors affecting the incremental costs of a shipment and the state of transport competition, which should affect the degree to which rates can be set above incremental costs.

Several components of rail costs are fixed with respect to distance. Costs of switching, classifying, and loading cars are not affected by distance shipped, and some line haul costs (acceleration to speed, for example) do not increase proportionately with mileage. As a result, costs and rates per mile should decline with distance.

Individual shipment sizes and annual volumes also affect per-unit costs. Grain is typically shipped in 100-ton covered hopper cars. The cost of a hopper rises less than proportionately with capacity, so costs and rates per bushel should decline as car sizes increase. In 1981, 70-ton boxcars were still in use in some Plains States. As lines were upgraded or abandoned and the 70-ton cars phased out, per unit costs and rates should have declined. Therefore, TONS/CARS should have a negative sign.

Shipments may move in single cars, multiple cars (typically 3, 5, 12, or 25 cars) or unit trains (50 to 130 cars). A shipment of three cars, for example, will normally be put into a mixed train of several commodities bound for various destinations, and then will be switched and reclassified onto new trains several times before reaching a final destination. Because switching and classification costs increase very little with shipment size, yard costs per ton decline with increasing tonnage. Therefore, rates per ton-mile should decline with increases in tonnage.

When shipment sizes increase to 50, 75, or 100 carloads, carriers can organize unit trains of a single commodity moving to a single location. Unit trains do not require multiple switching. If a shipper can generate enough volume over time, a carrier can dedicate equipment to that route and keep a unit train shuttling back and forth. Because of the regular nature of unit train operations, dedicated equipment is used more intensively, and the capital costs of such equipment may be spread over a larger volume of grain, lowering costs per bushel. For example, the first grain unit train, a 115-car Illinois Central train hauling grain to the gulf from Cargill elevators in central Illinois, made 57 round trips in its first year of operation, hauling 6,500 carloads of grain. Annual volume per car was three times the Illinois Central average for cars in single-car service.[8]

Competition from other modes (barges and trucks) and other railroads should affect rail rates. Barges, because of size-related economies, offer strong competition for rails. Shippers in regions near rivers would likely favor barges because of low cost. Railroads may raise rates for shipments originating farther from rivers.

The elevator operator or farmer faced with an undesirable rate has the option of trucking grain to the barge line. If distance is the major determinant of truck costs, then the distance from the barge location should be an effective measure of the strength of intermodal competition. Rail rates should accordingly increase with MIWATER, the mileage from competing water carriers (in practice, the distance from the origin point to the nearest point on the gulf, the Great Lakes, or the Ohio, Illinois, Mississippi, Missouri, or Arkansas rivers).

The Staggers Act encouraged competition among railroads through the abolition of rate bureaus, which had coordinated pricing among railroads, and the expansion of contracting, which eroded the use of posted tariff rates. Interrail competition works, in principle, through affected elevators. Elevators with favorable rates offer higher bid prices for grain, attracting grain from a wider region (trucked in from farms) and diverting grain from elevators on other railroads. Elevators with unfavorable rates can truck grain to customers or to

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[8] Other factors, such as topography, can indirectly affect costs and rates through shipment sizes. Unit trains heading on the low level route from Illinois to the gulf typically had more than 100 cars, while trains headed to Pacific Northwest ports over the Rocky Mountains from the Northern Plains typically had 52 or 54 cars. Poor track conditions may limit the weight and speed of cars and trains, and low crop yields or weak export demand may make it uneconomic to gather enough grain at an elevator to load a unit train.

other elevators. Again, trucks are the linking factor.

Railroads must coordinate many actions, such as interlining shipments (move from one railroad to another), or selecting equipment and trackage. Only a few railroads, usually one to four, operate in any particular region. Consequently, considerable skepticism exists about the potential for interrail competition. I anticipate that the new Staggers Act pricing practices will have reduced the effectiveness of coordinated behavior and introduced some degree of rivalry. I also expect that such rivalry will be greater as the number of competing railroads increase in an area. To measure the potential for such competition, I calculated the variable RRCOMP, as shown below. This approach presumes that a CRD is a relevant market. The choice is based on convenience, and its value will depend on usefulness in empirical analyses. But CRDs may be reasonable choices. They are larger than counties (most States have nine) and probably encompass the initial off-farm movements of grain fairly well. They are large enough that movements out of them impose more than trivial costs. RRCOMP is a Herfindahl index and varies from a minimum of 1 (a monopoly) to a maximum equal to the number of railroads in a CRD (it will equal that maximum if railroads have equal shares). RRCOMP increases with the number of railroads and the equality in their shares.

All continuous variables were specified in natural logarithms. The plotted relationship between MILES and RTM is clearly log-linear, and distance is a major determinant of rates. The log-linear form also imposes an attractive property on the relationship between competition and rates. The addition of a new competitor will affect rates more sharply when there are fewer existing competitors in a market. So, a shift from one seller to two has a greater impact on rates than moving from five sellers to six. Several observations on MIWATER cluster at values of zero (with undefined logs). For those observations, I set the log of MIWATER equal to zero, and entered a dummy variable, PORT (equal to one when MIWATER was zero), allowing the regression to determine a value for those points.

Several other dummy variables were entered. Q2, Q3, and Q4 aim to capture any seasonal variation in rates. Because 24 States continued to regulate intrastate rail movements, the dummy variable INTRA is entered to capture effects of State regulation.

Finally, I entered a time trend, T, equal to the year of the shipment, minus 1981. The coefficient on T gives information on rate trends, after controlling for size, distance, and competition. We can use time trend coefficients to investigate post-Staggers rate developments, interregional differences in rate trends, and the effect of unit train expansion on rail rates.

WAYBILL SAMPLE REGRESSION EQUATION

$$RTM = a_0 + a_1\,MILES + a_2\,TONS + a_3\,VOLUME + a_4\,TONS/CARS + a_5\,INTRA + a_6\,Q2 + a_7 Q3 + a_8\,Q4 + a_9\,PORT + a_{10}\,MIWATER + a_{11}\,RRCOMP + a_{12}\,MIWATER*RRCOMP + a_{13}\,T + u.$$

where:

RTM =	Revenue per ton-mile, calculated from Waybill data.
MILES =	Estimated shipment distance, in miles, also from Waybill data.
TONS =	Shipment size, in tons, from Waybill data.
VOLUME =	Annual estimated tonnage shipped between the origin and destination points coded on the Waybill record. Calculated by summing the weighted tonnage across all Waybill records with the specific origin and destination codes, where the weights are the reciprocals of the sampling probabilities.
TONS/CARS =	Mean tons per car in the shipment.
INTRA =	A dichotomous (0-1) dummy variable, equal to one if the shipment is intrastate.
Q2, Q3, Q4 =	Seasonal dummy variables for the second, third, or fourth quarter of the year.
PORT=	A dummy variable, set equal to one if the shipment originates at a barge or ship-loading location.
MIWATER=	Distance (miles) from origin point to nearest competing source of water transport (river, lake, or ocean).
RRCOMP=	A measure of competition among railroads in an area. It is a Herfindahl index (the reciprocal of the sum of squared market shares of railroads in a Crop Reporting District (CRD), where the market shares are the shares of all rail shipments of grain originated in the CRD).
T=	A time trend, set equal to 0 in 1981, 1 in 1982, 2 in 1983, 3 in 1984, and 4 in 1985.

RESULTS OF REGRESSION ANALYSIS SHOW RATE REDUCTION AFTER STAGGERS

Changes in shipment sizes led to rate declines, but most of the post-Staggers decline remains after we control for size effects.

Table 5 shows results of the regression analysis. Rates per ton-mile decline with distance: the coefficient on MILES is negative, large, and highly significant in each equation. The several shipment size variables (TONS, VOLUME, and TONS/CARS) also have large impacts on rates: as shipment sizes or volumes increased, rates per ton-mile decline. Note the differences in coefficient values for TONS/CAR and TONS between the wheat and corn samples. Collinearity among TONS/CAR, TONS, and VOLUME may help account for the differences, but sample differences also influence the results. Unit trains dominate the export movement of corn (table 4), and there may be only small rate effects for size shifts among unit trains. Wheat has a much wider variety of shipment sizes. Many corn shippers used smaller 70-ton boxcars in 1981, but the TONS/CAR variable showed little variation in the wheat sample because almost all wheat shippers were using 100-ton covered hoppers.

Table 5's equations (2) and (4) drop the size variables TONS and TONS/CARS. Shipment sizes grew over time in wheat, and I sought to determine the effect on the time trend when size variables were not controlled. The R^2-statistics drop slightly, and the seasonal dummy variables pick up increased t-statistics (typical shipment sizes have a clear seasonal component). The annual time trend wheat coefficient changed from -0.042 to -0.061. Wheat rates dropped an average of 21.7 percent during 1981-85 with no controls for shipment size shifts and 15.5 percent with controls. Corn rates declined by 12.4 percent with no controls for shipment size and 8.4 percent with controls. According to this analysis, about 30 percent of the rate decline can be attributed to the spread of multiple-car and unit train use.

Note the coefficients on the time trend, T. For wheat, they indicate that export rail rates fell 15.5 percent between 1981 and 1985, even when I control for shifts in shipment size. For corn, the 1981-85 decline was 8.4 percent. To compare results to the price spread studies, the reader should recall that the price spread studies did not control for changes in shipment size, and that they showed sharp price declines in 1981 relative to 1980, while the regressions of table 5 cover only trends between 1981 and 1985.

Wheat exports fell sharply in 1985, but that fall does not appear to affect the price trend. The coefficient on T is unchanged when we run a regression without 1985 data. The 1985 data, however, sharply affected corn results. Half of the estimated 1981-85 trend decline in corn rates occurred in 1985. Corn exports fell sharply in 1985, after 3 years of stability (table 2). Falling exports drove barge rates down in 1985, placing strong downward pressure on rail rates for corn (20). Again, wheat shippers are far from barge locations, so falling barge rates had a weaker 1985 impact on wheat rates.

Table 5--Regression analysis of export rail rates for wheat and corn, 1981-85

	Regression coefficients and t-statistics			
	Wheat equations		Corn equations	
Independent variables	(1)	(2)	(3)	(4)
CONSTANT	4.436	4.470	7.241	3.514
	(44.46)	(92.42)	(15.71)	(44.82)
MILES	-.602	-.590	-.307	-.291
	(102.50)	(110.04)	(37.77)	(37.78)
TONS	-.061		-.018	
	(25.80)		(6.26)	
TONS/CARS	-.016		-.809	
	(25.90)		(8.30)	
VOLUME	-.039	-.061	-.108	-.126
	(17.06)	(27.29)	(22.74)	(28.32)
INTRA	-.155	-.160		
	(24.15)	(24.00)		
Q2	-.064	-.078	-.040	-.029
	(8.13)	(9.65)	(2.88)	(2.02)
Q3	.001	-.011	.061	.056
	(.16)	(1.44)	(3.86)	(3.52)
Q4	-.012	-.026	-.017	-.026
	(1.43)	(2.98)	(1.28)	(2.03)
PORT	.807	.841	.310	.419
	(26.30)	(26.30)	(7.41)	(10.11)
MIWATER	.226	.240	.109	.135
	(41.65)	(42.71)	(10.40)	(13.02)
RRCOMP	.130	.081	.027	.099
	(3.34)	(1.99)	(.65)	(2.36)
MIWATER*	-.051	-.039	-.070	-.079
RRCOMP	(6.97)	(5.12)	(7.31)	(8.22)
T	-.042	-.061	-.022	-.033
	(18.40)	(26.72)	(4.80)	(8.16)
R^2	.692	.665	.542	.524
n	7,802	7,802	3,363	3,363

Dependent variable is revenue per ton-mile. All continuous variables are in natural logarithms. Numbers in parantheses are t-statistics. Equations (2) and (4) drop the size variables TONS and TONS/CARS.

REGRESSION ANALYSIS SHOWS EFFECTS OF COMPETITION BETWEEN RAILROADS AND FROM OTHER MODES

Increases in railroad concentration are associated with increased rates, where barge competition is distant.

Competition among railroads has a statistically significant, fairly strong effect on rates. More competitors, as measured by RRCOMP, are associated with lower rates. Interrail competition becomes more important as we move away from the water. (See opposite table.)

Addition of a competitor affects rates more when fewer competitors are in a market. For example, moving from a monopoly (RRCOMP = 1) to a duopoly (RRCOMP = 2) in a corn market 75 miles from water competition reduces rates by 17.4 percent, and moving further to triopoly (RRCOMP = 3) reduces rates another 15.2 percent.

Water Competition. Competition among railroads should have a weaker impact on rates where water competition is strong, and coordination among railroads should be more effective in raising prices, the weaker is water competition. To capture that effect, I entered an interaction term, MIWATER * RRCOMP, in the analysis. The coefficient sign should be negative. If truck competition is sufficient to render rail markets contestable, MIWATER and RRCOMP should have no effect on rates.

Water competition has important effects on rates. Holding other variables at representative values (800 miles, 100 tons per car, 5,200-ton shipment, 75,000-ton volume and two railroads), wheat shippers 500 miles from water competition paid rates 36 percent greater than shippers 100 miles away. No corn shippers were that far away. Shippers who were 200 miles away (6 percent of export corn tonnage originated at least 200 miles away) paid rates 6.2 percent greater than shippers 75 miles away from water competition. The barge results are consistent with the time series evidence of Fuller and his coauthors, who found that barge rates had strong contemporaneous effects on rail rates in the Corn Belt. One-dollar reductions in barge rates were associated, on average, with 50-cent reductions in price spreads (through rail rate declines). In unreported regressions, Fuller's barge rate effects varied with distance from the water. In east-central Iowa, for example, $1 barge rate changes were associated with 90-cent price spread changes. Away from the rivers, in central Indiana, barge rate changes of a dollar led to 30-cent price spread changes.

The PORT variable has an interesting effect that mirrors results in (38). Recall that PORT equals 1 for originating points on rivers or the Great Lakes (that is, MIWATER is zero). The coefficient on PORT is positive and highly significant, implying that shippers facing immediate water competition pay relatively high rail rates. I offered an explanation in my earlier paper: water costs are low enough relative to rail that a riverside shipper who chooses rail must have an unusual reason for doing so (a time constraint, a freeze, a sales opportunity away from the water) that effectively removes the constraint of water competition. In any case, several good statistical reasons point to why one should not be overly concerned with the positive coefficient on PORT. First, PORT covers relatively few observations (1.5 percent of wheat and 3 percent of corn). Second, the coefficient is not large. In each sample, coefficient values indicate that shippers who operate more than 35 miles from the water pay higher rates than those at PORT. Few rail shippers are within 35 miles of the river, because water is the dominant mode at that range. Third, including the PORT dummy allows us to see the effects of MIWATER more clearly. Competition from barges and other railroads has important rate effects. The results suggest that railroad grain transportation is not a perfectly contestable industry.

COMPETITION MEASURE USED IN REGRESSION MODEL

$$RRCOMP = \left(\sum_{i=1}^{n} S_i^2\right)^{-1}$$

where S_i = Share of railroad i in all railroad movements of grain originating in a Crop Reporting District (CRD).

RRCOMP is a Herfindahl index, which varies between 1 and the total number of railroads in a CRD. RRCOMP increases with the number of railroads and the equality in their shares.

EFFECTS OF ADDING A RAIL COMPETITOR

In the wheat sample, adding an equal-sized rail competitor to a monopoly at a point 200 miles away from water reduces rates by 10.2 percent. At 500 miles away from water, the effect is 13.8 percent. Adding a competitor for corn 75 miles away from water reduces rates by 17.4 percent, while at 200 miles, the effect is 21.3 percent. If we drop the interaction term from equations 1 and 3 (of table 5), the competitor coefficients change as follows:

	Wheat	Corn
MIWATER	0.199	0.087
t-statistic:	52.82	9.77
RRCOMP	-.153	-.256
t-statistic:	19.56	13.65

Other coefficients showed no important changes. Including the interaction term provides statistically significant improvements in fit, using F tests at 1-percent confidence levels.

REGIONAL DIFFERENCES IN RATE TRENDS

Rail deregulation has had a stronger effect on rates in the Plains States than in the Corn Belt.

Rail regulation had stronger effects in the Plains States than in the Corn Belt, and evidence points to a range of experiences under deregulation across regions.

To assess regional differences, I ran separate regressions on observations grouped by commodity, origin State, and regional destination (for export movements, that means the Atlantic, gulf, and Pacific coasts, and ports on the Great Lakes). This breakdown preserves meaningful geographic areas and useful sample sizes. I ran two regressions. First, I regressed rates on MILES, VOLUME, and T.[9] In the second regression, I added TONS and TONS/CARS (and continued to use logarithmic transformations). The effect of shipment size shifts can then be seen by comparing the coefficients on T in the two regressions. In tables 6 (wheat) and 7 (corn), the first term in each cell is the gross (without shipment size controls) 1981-85 rate trend, while the second is the net trend, after controlling for shipment size shifts.

Wheat. Consider, the wheat results first. The wheat data showed gross rate declines in all corridors, and almost all declines are statistically significant at a 1-percent level of confidence. Rate declines were widespread during the period, not confined to a few States or destinations. Note that shipment sizes tell an important part of the story, however, because net rate declines are usually well below gross rate declines. The rate difference is greatest among movements to the Pacific coast, especially to the Pacific Northwest from Idaho, Montana, and Washington (the movements from Texas to California showed little trend in shipment size). The estimates for movements from the Dakotas and Nebraska to the Pacific coast showed small shipment size effects. However, these origin points shipped little wheat to the Pacific coast prior to unit train introduction, so the net-gross differences are somewhat misleading.

Unit trains led to substantial rate cuts in these corridors. Most of the rate decline to the Northwest seems due to increases in shipment size, particularly the spread of unit trains, which began in late 1981 and grew to half of northwestbound tonnage by 1984. By contrast, movements from Minnesota and the Dakotas to Duluth/Superior (lakes) showed modest effects of increases in shipment size. Unit trains were relatively unimportant, but multiple-car movements, typically 3 to 12 cars, handled 85 percent of Duluth/Superior tonnage by 1985, up from 30 percent in 1981. Movements to the gulf showed a more mixed picture across States. All movements showed major rate cuts, but shipment size shifts accounted for varying parts of the total.

Corn Belt. Wheat gross and net rates declined in all corridors. Corn's pattern differed (table 7). There are clear regional differences: movements from the eastern Corn Belt (Indiana, Michigan, and Ohio) show trend increases, while movements to the Great Lakes, gulf, and Pacific coast show pronounced trend declines.

Important shipment size effects appear only on rate trends on movements to the Pacific Northwest. Unit trains were in widespread use along gulf and Atlantic coast corn corridors by 1981, so shipment size shifts were not to be expected. Unit trains of corn to the Pacific coast, which originate in the Plains States with weak barge competition (Nebraska, South Dakota, western Iowa) were not introduced until after deregulation, consistent with a theory of regulation which posits rate equalization.

The large declines on corn movements to the gulf provide further evidence of the strength of barge competition in that corridor. Most of the rate declines on Great Lakes, gulf, and Pacific coast routes occurred in 1985, when exports and barge rates plunged. The gulf and Great Lakes routes did show statistically significant but much smaller trend declines in 1981-84 when we used separate dummy variables for each year, rather than a trend. By contrast, movements to the Atlantic coast, which originate in areas with weaker barge competition, show only small negative 1985 effects on rates.

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[9] The competition variables varied much less within particular State-coast combinations than across them, so I dropped the competition variables from these "within corridor" regressions.

Table 6--Wheat export rail rates, 1981-85 trends with and without controls for shipment size

Originating State	Destination coastal region					
	Lakes		Gulf		Pacific	
			Percent changes			
Idaho					-16.1*,	5.0
Kansas			-15.1*,	-8.6*	-16.5**,	-3.4
Minnesota	-20.2*,	-18.1*				
Montana					-23.8*,	-18.5*
North Dakota	-18.5*,	-17.1*			-20.7*,	-20.7*
Nebraska			-31.0*,	-23.2*	-11.8**,	-7.7
Oklahoma			-13.5*,	-3.3		
South Dakota	-43.1*,	-29.4*				
Texas			-29.8*,	-25.7*	-14.4*,	-14.3*
Washington					-20.0*,	-8.8*

First term of each pair is 1981-85 price trend calculated from regression equation: Ln RTM = a_0 + a_1 Ln MILES + a_2 Ln VOLUME + a_3 T; second term is 1981-85 price trend calculated from regression: Ln RTM = a_0 + a_1 Ln MILES + a_2 Ln VOLUME + a_3 Ln TONS + a_4 Ln TONS/CAR + a_5 T. Single asterisk denotes 99-percent significance; double asterisk denotes 95-percent significance.

Table 7--Corn export rail rates, 1981-85 trends with and without controls for shipment size

Originating State	Destination coastal region					
	Atlantic		Gulf		Pacific	
			Percent changes			
Iowa			-26.1*,	-27.6*	-28.9*,	-30.7*
Illinois	84.0*,	99.8*	-28.5*,	-28.5*		
Indiana	-3.5,	3.2				
Michigan	7.2**,	5.9**				
Minnesota			-68.4*,	-65.7*	-31.1*,	-22.9
Nebraska			-33.5**,	-26.6	-35.6*,	-22.6*
Ohio	-5.3**,	.7				
South Dakota					-42.9*,	-35.3*

Annotation same as table 6 above.

EFFECTS OF SHIPMENT SIZE SHIFT

Staggers reforms accelerated the cost-reducing adoption of multiple-car and unit train operations. Price indices which are fixed regarding shipment size may give misleading evidence.

There has been a large variety of rate changes since passage of the Staggers Act. On average, and especially in the Plains States, rates have declined. We have not seen the widespread increases that might have occurred had agriculture been systematically subsidized in the regulatory rate structure. Further, the rates have been stated in nominal terms. If we adjust for input cost increases, we would see larger declines in real rates.

The structure of rail rates has shifted among regions and among shipment sizes. The Staggers Act reforms have had a major influence on the rate structure by introducing competition in some regions and by further eroding the policy of rate equalization.

The most striking developments are the rapid spread of multiple-car and unit train shipments and the sharp decline in single-car movements. While unit trains were the principal means of moving export corn before the passage of Staggers, single-car domestic corn movements were still quite common but have virtually disappeared since 1981. Unit trains have spread rapidly on export wheat corridors, but it is important to emphasize the general decline of single-car movements on virtually all grain corridors.

The shift toward multiple-car use accounted for an important part of the overall rate decline, especially for shipments originating west of the Mississippi River. If we do not control for such shifts, and do not believe that they were induced by deregulation, then we may overestimate the effect of Staggers on rail rates, especially in analyses of price spreads, which typically have not been able to control for changing shipment sizes.

The spread of multiple-car movements should have other important effects as well. Factor productivity should increase as larger shipments increase capacity utilization of railcars. The shift is also part of a general trend toward consolidation of grain merchandising in fewer but larger elevators. Such elevators have relatively large catchment areas, and consolidation may lead to rural road deterioration as farmers invest in heavier trucks to move larger loads farther (6,31).

Effects on Rail Freight Price Indexes. Changing shipment sizes also has important effects on calculated price indices for rail services. The Bureau of Labor Statistics (BLS) reports that its railroad freight price index for grain, a component of the producer price index, rose by 26.2 percent between December 1980 and December 1984 (50). The grain index reported by the Association of American Railroads (AAR) declined by 18 percent during the same period (4). The BLS index is fixed with regard to shipment sizes, and the BLS sample was derived from the 1976 ICC Carload Waybill Sample that systematically underestimated the prevalence of unit trains (26). Therefore, the BLS measure misses the most important sources of any 1980-84 rate decline. In contrast, the AAR index appears to include only those sources. The index includes shipment size shifts but measures rate changes on only the most heavily traveled routes, while ignoring secondary and branch line corridors most likely to have had increases.

EFFECTS ON STANDARD RAIL RATE INDICES

- BLS Railroad Freight Price Index for Grain . . . between December of 1980 and 1984, rose 26.2 percent.

  The BLS index is fixed with regard to shipment size, and was derived from 1976 Waybill sample, which understated unit train use.

- AAR Grain Rate Index . . . between December of 1980 and 1984, *declined* 18 percent.

  The AAR index captures shipment size shifts, but sample of most heavily travelled routes overrepresents unit trains.

RATE REDUCTIONS DUE TO STAGGERS

The Staggers Act had an effect on rail rate reduction substantially separate from U.S. export decline and from the carriers' shift to less expensive methods, such as multiple-car and unit trains.

Did the Staggers Act cause or accelerate the shipment size shift? The timing of the shift and the geographic pattern suggest that the act had a strong influence. Multiple-car wheat rates were first introduced in the Plains States in the aftermath of deregulation (29), and a rapid shift of tonnage followed (tables 3 and 4).[10] However, there may have been other causes.

First, unit train use spread throughout the Corn Belt in the 1970's under a period of continuing, albeit weakening, regulation. Introduction and diffusion of unit trains across Plains locations may have come later only because Plains region crop yields were lower (making it more costly to assemble unit train loads at an elevator), and corridor flows were not yet dense enough to justify multiple-car shipments. As export volumes increased and consolidation of the wheat industry proceeded apace, the Plains rail system might have eventually shifted away from a single-car distribution system even without deregulation.

Such external factors clearly have a strong influence on the decision to adopt a multiple-car system. However, they do not account for the abrupt timing of the introduction of new rates, the completion of facilities, and the rapid movement away from a single-car system. Although many remote wheat areas of the Plains had low yields and modest flows of grain, these areas feed into major transshipment points (Kansas City, Fort Worth, Enid). The heavy flows from those points were ideally suited to multiple cars and unit trains long before deregulation and the actual shift in shipment sizes. Finally, the corridor pattern of the shift shows that it did not occur solely in anticipation of increased export volumes, because single-car movements also declined sharply on domestic moves. And, single-car shipments still held respectable shares of domestic Corn Belt traffic in 1981 even after unit trains were well established on export routes. Those shares dwindled rapidly, however, in the aftermath of the Staggers Act.

A second possible cause of the shipment size shift, unrelated to Staggers, was barge competition. Recall that unit trains were introduced in the Corn Belt in the 1970's in response to barge competition. With the sharp declines in barge rates in the early 1980's, more elevators in remote areas could consider the truck-barge alternative to rail. In short, the barge hinterland widened and railroads responded by introducing multiple-car and unit train rates.

The barge competition theory is quite plausible, especially on timing. But it fails to account for some key characteristics of the shift, such as the erosion of single-car movements on domestic corn routes which already faced barge competition. The theory also does not account for the shifts in the western Great Plains, outside the widened range of barge competition. Most important, the theory does not explain why a cost-reducing innovation would be introduced only under the pressure of barge competition. The hypothesis that the Staggers Act ended the policy of rate equalization, however, explains the timing and pattern of the shift to multiple cars and unit trains.

The shipment size shift has clearly placed downward pressure on rail rates. Declining export volumes have reduced rates in several regions, leading to an important question: has rail deregulation had any direct effect on rates, after one controls for export influences and shipment size effects? I believe that it has, and that the regional pattern of the effects suggests that deregulation introduced competition among railroads in regions with evidence of prior effective cooperation.

We know how shipment size shifts influenced rates, so consider the estimates of rate changes, once we have controlled for trends in shipment size. These are the right-hand terms in tables 6 and

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[10] Wilson notes that multiple-car wheat rates were introduced in North Dakota in July of 1981 but that at least some of the rates were docketed with the ICC (proposed) before passage of Staggers in October of 1980 (55). The timing of these events (proposal and implementation) illustrates the difficulty in choosing a specific date for the shift from regulation to deregulation. The ICC was clearly oriented to deregulation in 1979-80, when it aimed to encourage greater use of contracts and multiple-car rates. The Staggers Act provided an important validation of ICC actions in this regard. More important, the act added permanence to the policy, ensuring that it would not be reversed by a new Commission. The widespread adoption of contract rates then occurred after passage of Staggers.

7. Can export movements alone adequately account for the pattern? I doubt that they can, first because of timing. Wheat exports peaked at 48.2 million metric tons in 1981. Rail rates and price spreads between Kansas local elevators and the gulf peaked in the first quarter of 1981 and then began to decline, with spreads falling by 14.5 percent and posted tariff rates by 7 percent by the fourth quarter of 1981. Multiple-car tariff and contract rates were introduced in Kansas in 1981 (29).

Second, Fuller and others found that export volume had a statistically significant, but small, direct effect on price spreads for corn and wheat. The elasticity of the price spread with respect to export volume was 0.1, too small to account for the observed rate and price spread movements (20).

Export volumes also had indirect effects, through barge rates, which dropped by as much as 50 percent during 1981-85. Barge rates had a strong impact on rail rates in the Corn Belt but no significant effect on wheat movements from the Plains (barges have the leading share of export corn movements but a negligible share of wheat) (20). The barge channel clearly influences rail rates in such regions as Illinois and Iowa (table 7). However, rail rates (adjusted for shipment size) also fell on wheat movements from the Plains to the gulf and Pacific while increasing on eastern corn movements (Indiana and Ohio to the Atlantic). Moreover, wheat and corn exports dropped sharply in 1985. Rail rates for corn rates declined, especially along the barge channel. The 1985 export decline, however, had no effect on wheat rate trends. So export and barge effects can account for only part of the observed pattern.

The remaining rate declines are concentrated in the Plains. Before deregulation, rates in the Plains were relatively high, because of the lack of barge competition (19,48). Because the Staggers Act was designed in part to induce more competition among railroads, by abolishing rate bureaus and expanding contracting, new competition should have had little effect on rates in regions where barge competition was strong. If Staggers successfully introduced interrail competition, the effect should be felt most strongly in the Plains States. Table 5 indicates that interrail competition appears to exist in the deregulated environment, and the pattern of rate changes since Staggers suggests that new and effective interrail competition was introduced in the Plains as a result of deregulation.[11]

Rate trends since deregulation provide us with an opportunity to assess theories of the effects of ICC rail regulation. There is strong evidence against one theory: ICC rail regulation does not appear to have aimed at protection of agricultural shippers, since grain rates have generally fallen during the 1980's. Evidence points in favor of the view that rail regulation served to allow cartel pricing in some regions and that regulation aimed to protect small shippers through a policy of rate equalization. Rates have fallen most clearly in Plains States where a cartel and a rate equalization policy would be most effective. In the Corn Belt, where barge competition makes for a less effective rail cartel, rail rates subject to barge competition have responded to barge rate cuts while other rates have risen slightly.[12]

[11] The statistical results are consistent with recent evidence for another bulk product, coal. Atkinson and Kerkvliet report that rail rates for coal movements out of Wyoming's Powder River Basin fell by up to 30 percent after the Chicago and Northwestern opened a line into the Basin to compete with the Burlington Northern (5).

[12] In comments on this report, Sorenson contends that the principal effect of Staggers has been to undermine cartel pricing among railroads, and that the effects of regulatory pricing structures aimed at rate equalization were relatively unimportant. Sorenson and this author see Staggers allowing a shift to a pricing system reflecting the lower costs of large shipments. But in my view regulation directly prevented the realization of such a pricing system through the regulatory policy of rate equalization. Sorenson argues that an effective rail cartel would not have introduced the new pricing system, but that the competitive provisions of Staggers undermined the cartel. Because the regulated pricing system was so complex, it is extremely difficult to establish a general ICC policy through a review of decisions (10). My principal difficulty with Sorenson's view is that I do not see why a cartel should oppose a cost-saving innovation, and the new pricing system clearly allows for much lower costs. That said, the pricing system may undermine cartel discipline by making it harder to observe cheating on the cartel price and may have been opposed for that reason.

CHANGES IN THE PATTERN OF GRAIN FLOWS -- SOYBEANS AND WHEAT

The Waybill data show an important increase in export flows from Nebraska and the Plains to the Pacific Northwest, as well as other regional effects.

Changes in rates, shipment sizes, and railroad ownership may lead to changes in the patterns of grain flows, as shippers face altered patterns of relative prices.

Tables 8-11 detail selected State-to-State rail flows of major grains from originations in several producing States. Barge and truck flows are not included in the tables and, again, 1981 data omit the first half of the year.

Several factors determine the volume and direction of grain flows originating in a particular State. States that are deficit producers of a commodity (State consumption exceeds State production) will have essentially local movements. For example, Georgia soybean originations (table 8) were overwhelmingly local, with at least 70 percent terminating in Georgia, and at least 88 percent in 1983-85. Interstate flows are small and nearby, to Alabama and Mississippi. Major export commodities produced in States on the edge of a production region tend to have concentrated flows. For example, Montana wheat (table 9) tends to flow almost exclusively to the Pacific Northwest (Washington and Oregon), while Oklahoma originations flow almost exclusively to Texas (table 10).

Because of the short time since deregulation, and the important coincident effects, new trends in the flow data cannot be easily discerned in the deregulatory period data. But, some interesting developments in the Northern Plains do stand out. First, the data show an important increase in rail flows of wheat to the Pacific Northwest from Nebraska, North Dakota, and more modestly from Minnesota. The Waybill data show an increase in 1982-85. The 1980's flows exceeded the flows recorded in the 1977 survey of Hill, Leath, and Fuller (26). Second, the 1977 survey data (26) showed that barley flows from Montana and North Dakota to California and Arizona went exclusively by truck. In 1983, railroads moved 500,000 tons of barley (equivalent to 100 50-car unit trains) to California and Arizona, and they carried 335,000 tons in 1985. Third, in the 1970's, trucks were gaining an increasing share of the eastbound (Minneapolis/St. Paul/Duluth Superior) grain flows from Minnesota and North Dakota. I do not have truck data, but the Waybill data show increasing rail tonnages of barley and wheat on those routes in the 1980's.

Table 8--Destinations of rail soybean flows from Georgia

Destination State	1981	1982	1983	1984	1985
			1,000 tons		
All States	417	669	762	497	502
			Percentage of annual tonnage		
Alabama	12.2	16.6	5.7	1.6	3.9
Florida	0	0	0	0	.7
Georgia	77.1	70.5	90.1	88.5	88.1
Kentucky	.8	0	0	0	0
Louisiana	0	0	.8	0	0
Mississippi	9.2	7.1	0	3.3	4.5
North Carolina	0	.8	0	0	0
South Carolina	.8	2.7	1.9	3.5	2.8
Tennessee	0	2.6	1.9	3.2	0

Source: ICC Waybill statistics.

Table 9--Destinations of rail wheat flows from Montana

Destination State	1981	1982	1983	1984	1985
			1,000 tons		
All States	1,310	3,284	3,393	2,620	1,702
			Percentage of annual tonnage		
Arizona	0	0	0	0	.7
California	0	0	.5	.3	1.8
Colorado	0	0	0	0	2.4
Minnesota	.6	.9	1.2	.3	3.0
Missouri	0.0	0.0	0	0	1.4
Montana	3.9	1.5	.8	1.7	2.1
North Dakota	0	0	.3	.4	0
Oregon	52.8	34.4	43.7	42.2	33.4
Texas	0	0	0	0	.6
Washington	42.6	62.9	52.6	54.9	54.5
Wisconsin	0	.3	.8	.3	0

Source: ICC Waybill statistics.

Table 10--Destinations of rail wheat flows from Oklahoma

Destination State	1981	1982	1983	1984	1985
			1,000 tons		
All States	1,763	4,948	3,968	6,082	3,556
			Percentage of annual tonnage		
Alabama	0	0	0	.3	0
Arizona	0	0	.1	.2	.9
California	2.3	0	0	.4	.2
Kansas	2.8	3.7	1.2	1.4	1.0
Louisiana	1.3	0	0	0	0
Missouri	.5	.1	.4	.2	.2
Nevada	0	0	0	0	.1
Oklahoma	13.3	24.0	20.0	24.5	27.8
Texas	79.8	72.3	78.3	72.9	69.6

Source: ICC Waybill statistics.

CHANGES IN THE PATTERN OF GRAIN FLOWS -- CORN

For the 1981-85 period, the Waybill data showed increased flows of corn from Indiana to Illinois and from Illinois to barge points, due to sharp declines in barge rates.

The flows of wheat should be compared with the pattern of corn movements from Indiana (table 11). Corn has important domestic demands, and Indiana is centrally located. In 1985, eight States received at least 5 percent of Indiana grain shipments. The major directions included poultry-producing regions in Georgia and Alabama, ports in Maryland,Virginia, and Pennsylvania, and domestic uses and riverports in Illinois and Indiana.

State-to-State flows often fluctuate widely across years. Again, consider Indiana corn (table 11). Corn exports fell sharply in 1985, and Atlantic coast flows to Maryland (Baltimore), Pennsylvania (Philadelphia), and Virginia (Norfolk) were 50 percent below the 1982 flows. Barge rates fell sharply relative to Corn Belt rail, so increased flows to barge locations should be expected. Indiana shipments to points in Illinois, Indiana, Ohio, and Tennessee (all on rivers) increased from 699,000 tons in 1982 to nearly 2.5 million tons in 1985. Under the same barge rate pressure, direct rail flows from Illinois to Louisiana and the Atlantic coast fell by half during 1982-85 (from 3.5 million tons to 1.7 million), while shipments to Illinois barge sites more than doubled from 900,000 to 2.1 million tons.

A unit train offloads grain which is then conveyed into waiting Mississippi River barges for movement to the gulf (photo courtesy of Briggs Business Communication).

Table 11--Destinations of rail corn flows from Indiana

Destination State	1981	1982	1983	1984	1985
			1,000 tons		
All States	2,445	7,852	6,500	5,309	6,940
			Percentage of annual tonnage		
Alabama	8.5	8.0	5.7	4.9	5.6
Arizona	0	0	0	.1	.1
Delaware	0	0	2.3	1.6	0
Florida	4.7	2.4	2.5	.9	1.1
Georgia	16.2	16.6	18.5	19.5	19.3
Illinois	2.3	2.0	3.8	5.1	6.7
Indiana	1.2	2.2	4.6	8.2	11.8
Kentucky	1.1	1.1	1.2	2.7	1.5
Louisana	0	0	0	2.0	1.0
Maryland	34.8	35.0	26.1	11.2	24.9
Missouri	.8	0	.1	0	0
Massachusetts	.8	1.0	.8	.8	.7
North Carolina	1.2	2.8	3.6	5.5	1.0
New York	0	.2	.9	1.9	.3
Ohio	2.4	.6	.5	5.1	5.6
Pennsylvania	12.0	11.2	12.5	11.0	3.0
South Carolina	0	.6	1.1	1.2	.4
Tennessee	3.4	4.1	6.7	7.9	11.2
Texas	0	0	.1	0	0
Virginia	11.5	12.2	9.1	10.5	5.6

Source: ICC Waybill statistics.

SPINOFFS AND ABANDONMENTS

Class I railroads have reduced their systems via abandonments and sales, and many short-line and regional roads have taken over light-density branch lines.

One important criticism of railroad regulation prior to Staggers was that regulation reduced rail profits and diverted funds away from investment in high-volume main lines by forcing railroads to keep operating unprofitable branch lines. Restrictions on service cutbacks contributed to the railroads' poor financial condition and directly affected the viability of parts of the rail system (34,52). The agricultural community's interest in the issue arises from the perception that many light-density branch lines help serve rural areas and agricultural shippers. Line abandonments accelerated in the late 1970's, as abandonment procedures were eased by provisions of the 4R Act, the Staggers Act, and by ICC administrative actions. Between 1976 and 1981, Class I railroads abandoned over 15,000 miles of road, about 8 percent of the 1975 system (2). The emphasis shifted in the 1980's as Class I railroads started selling off branch lines and regional systems to independent operators. Between 1970 and 1984, 139 new small railroad companies were formed, operating 7,800 miles of track (15,16). Twenty-nine of those companies, with 1,000 miles of track, went out of business by 1984, and 11 more shut down between 1984 and 1986, leaving 99 firms with 6,000 miles. After 1984, 66 new short-line operators, with 2,500 miles of track, entered the system, and six larger regional carriers began operations on about 3,600 miles. Thus, by late 1986, short-line and regional railroads operated systems of about 12,100 miles.

Five of the six new regional carriers were formed from spunoff parts of the Illinois Central Gulf (ICG) system, which restructured itself into essentially a north-south trunk system. The sixth regional carrier took over 873 miles of Chicago and Northwestern (CNW) trackage in Iowa, Minnesota, and South Dakota. The former CNW lines, and two of the former ICG systems, had served important midwestern grain areas. In 1987, two other carriers announced plans to spin off regional midwestern systems. The Soo line sold its Lake States Division (Michigan, Minnesota, and Wisconsin) to an independent operator, and the Burlington Northern began exploring the possibility of spinning off branch lines in the Northern Plains. Because the BN branch lines would feed into BN main lines, buyers would continue to be closely linked to the BN.

Class I railroads have reduced their systems following deregulation, as expected (2). The Class I system was 24 percent smaller in 1985 than in 1975 (145,764 miles of road owned, compared with 191,520 in 1975). However, important parts of the system have been spun off, rather than abandoned as expected. Will these new operations be viable? And, assuming viability, what advantages do regional and short-line operators have over Class I systems that enable them to operate these systems?

By one measure, the systems appear to be viable. Most of the mileage is still operating, and in many cases, moving more traffic than before. While many of the initial acquisitions had been made with State and Federal financial aid, Government support is now limited, and a network of private venture capitalists, entrepreneurial regional operators, and line brokers has coordinated the recent regional spinoffs. But success is still not assured, because earnings have been marginal at best on many of the lines.

Short-line and regional railroads may have several advantages over a larger trunk system. First, they have typically faced lower labor costs. Some have been nonunion operations, but unions have also been willing to negotiate wage and work rule concessions with new operators. Concessions on work rules, which assign specific tasks to specific occupations, are especially important. A given work rule may be particularly onerous to a short-line operator, because the volume of operations is rarely large enough to allow specialization in particular tasks. Rather, workers may perform a variety of jobs. Second, short-line managers may be more effective at local marketing than the larger organizations. Marketing may be especially important because most of the new operations face sharply declining costs as volume increases. If new operators can increase traffic, they may realize much lower unit costs than Class I operators.

Volumes for a branch line depend on regional agricultural production and on the existence of some additional industries along the line. Competition from other lines or other modes can reduce the viability of the line. It follows that abandonments rather than spinoffs would more

likely occur in areas like Iowa that have a relatively dense network of underutilized lines.
Finally, spinoffs may be an intermediate point on the way to abandonment. That is, we may see spinoffs rather than abandonments because of the initial availability of government financial aid and willing, but struggling, operators. Such a possibility seems smaller today with the emergence of a private for-profit financial network and large regional operators, but is still a likely result for at least some operations.

The recent service developments indicate that the transport system for grain is changing slowly toward an industry in which Class I railroads will operate mainline systems that serve large elevators with unit train loading facilities under contract rates. Away from the main line, a short-haul gathering and merchandising network will evolve, built around farm storage and elevators. Commercial trucking services are likely to expand to handle longer and larger first-handler moves and will compete with the evolving network of short-line and regional railroads for short-haul moves on light-density routes (42).

The decline of single-car movements indicates that railroads may be ceding much of the short-haul gathering function to trucks as branch lines are abandoned and single-car rates rise relative to multiple-car rates. At the same time, multiple-car rates have allowed railroads to reclaim medium-distance traffic from trucks (for example, on movements from Minnesota and the Dakotas to Duluth/Superior).

EMERGENCE OF NEW REGIONAL CARRIERS

- Illinois Central Gulf (ICG) restructured to north-south trunk, spinning off six regional carriers.
- Chicago and Northwestern (CNW) lines in Iowa, Minnesota, and South Dakota restructured into three regions.
- Soo Line sells Lakes States Division in Michigan, Minnesota, and Wisconsin to independent regional.

By late 1986, short lines and regionals operated 12,100 miles of line, compared with the 15,100 miles abandoned by Class I roads in the period 1976-81.

DETERMINING MARKETS IN WHICH SHIPPERS ARE CAPTIVE

Staggers retained rate regulation in captive markets. Where are grain shippers most likely to be captive?

Regulation of competitive shipments was widely thought to have restrained railroad innovation and reduced competition by and among railroads (52). The Staggers Act recognized that not all rail markets were competitive, and the ICC retained the power to regulate maximum rates charged to captive shippers.

Implementation of the regulatory sections of the act requires the ICC to settle two difficult issues: how to delineate markets in which railroads hold substantial market power, in which shippers are captive; and, once the ICC defines the scope of its regulatory power by defining captive shippers, how to decide on a method of setting rates for those shippers. Neither step is simple, and the ICC has moved slowly toward a policy.

The first issue concerns the identification of noncompetitive markets. Table 5 shows that wheat shippers who were 400 miles from the water paid rates 40 percent higher than shippers who were 100 miles from the water for otherwise identical shipments. The strength of water competition varies widely as we move across production regions. Half the corn shipments in the Waybill sample comes from points within 97 miles of a water point, and three-quarters of the shipments are within 140 miles. The truck-barge combination provides strong competitive pressure in most regions of the Corn Belt. By contrast, half of the Waybill wheat shipments originate at points at least 300 miles from water competition. Columbia River barges provide strong competition in the Pacific Northwest. In Minnesota and the eastern Dakotas, trucks offered some competitive pressure on the relatively short routes to Minneapolis and Duluth. Barges also carried some wheat from eastern portions of the Southern Plains on the Missouri and Arkansas rivers. However, river characteristics (shallower and narrower than the Mississippi) limit the size of barge tows and make for relatively high-cost barge transport. The competitive presence of these rivers does not extend far into the Plains. Other railroads also can provide competition. The regression analysis shows that rates fall as the number of competing railroads increase. The strength of interrail competition varies across production regions (table 12). Corn and soybean CRDs were generally more competitive than wheat CRDs. Railroad monopolies existed in only three corn and soybean CRDs, while 37 of 51 CRDs had at least three railroads. Ten wheat CRDs had but a single railroad, while 23 of 52 have at least three.

Wheat CRDs showed a clear geographic pattern of competition. Northern Plains and Pacific Northwest CRDs generally had only one or two railroads. Eastern halves of Kansas, Nebraska, Oklahoma, and Texas have strong railroad competition, sometimes four or five railroads. Western sections of those States, and eastern Colorado, are more likely to be duopolies. Competition is weakest in the Northern Plains in Montana and North Dakota. Competition is also quite limited in the western parts of the Southern and Central Plains States of Nebraska, Kansas, Oklahoma, and Texas. Mergers among competing railroads were most likely to reduce competition in these regions.[13]

The ICC did not find a market to be dominated by a single railroad in any grain producing region, until 1987, when the ICC found that the Burlington Northern was dominant in the market for Montana wheat and barley and thus was subject to rate regulation by the ICC (54).

Evidence in the report indicates that Montana has the weakest competition, either from railroads or from truck-barge combinations. The evidence also shows that railroads could exploit the lack of competition by charging considerably higher rates than in competitive markets. Therefore, it's fairly easy to establish that the BN is market dominant in Montana grain. The next step, establishment of a proper maximum rate, is considerably more difficult.

[13] Horizontal mergers may allow for the realization of cost savings. Most rail cost studies find important economies of density in that cost per ton on a route declines significantly with increased volumes on the route (28). Most routes have not exhausted economies of density, so mergers may allow for the reallocation of traffic to obtain economies of density. In such cases, policy must weight the efficiency gains from potential economies of density against the associated losses in competition from a merger.

Table 12--Distribution of Crop Reporting Districts, by number of railroads

	Number of railroads							
Crop	1	2	3	4	5	6	7	Total
	Number of CRDs							
Corn/soybeans	3	11	19	11	2	3	2	51
Wheat	10	19	10	7	6	0	0	52

Origin points were matched to counties and then to Crop Reporting Districts, through the CRD county code listing of USDA's National Agricultural Statistics Service.

Source: Author's calculations, based on origins and railroads reported in the ICC Waybill file.

ISSUES IN SETTING REGULATED RATES

The key problem in regulated railroad pricing is allocation of overhead among shippers. Limited information makes for a complex problem.

One possible regulatory rate-setting strategy is to set rates equal to the marginal costs of the shipment. Rates on routes that face intense truck-barge competition probably are close to marginal costs. Marginal cost pricing has attractive efficiency properties. Shippers will utilize the service up to the point that its value to them equals the resource costs to society. However, universal marginal cost pricing on all routes is not feasible in the rail industry because marginal costs are often below average costs. Universal marginal cost pricing would result in losses for the railroads, which are unlikely to be subsidized by the Government.

Another regulatory strategy would set rates on all routes equal to estimated average costs, including a share of overhead expenses. But then many shippers on competitive routes would likely obtain truck-barge rates that were below estimated railroad average costs but above marginal costs. Under average cost pricing, the railroad would lose those shippers and their contribution to railroad overhead (fixed costs), the difference between the rate charged and marginal costs. Loss of competitive business would leave overhead spread among the fewer remaining shippers, pushing up average costs and rates again. A cycle would develop where a few more shippers would find truck-barge combination rates to be below the railroad's average cost rates. As shipper defections mount, railroads would find themselves losing business to competing modes. Many captive shippers would find their own positions deteriorating as average costs and rates to them continued to rise. Pre-Staggers regulation often set such cycles in motion (17,18,37,40).

The key problem in regulated railroad pricing is allocation of overhead among shippers. Because marginal cost pricing with Government subsidies is not feasible (and may not be desirable), and because average cost pricing will push some shipments from railroads to barges or trucks, some form of price discrimination will probably be necessary. Shippers on noncompetitive routes will pay higher rates than those on competitive routes. By price discrimination, I refer to rates that may vary with demand conditions, even if marginal costs are identical. The definition is important because historical prohibitions on railroad price discrimination often imposed equal rates on shipments with sharply different marginal costs (10,35,37).

Ramsey pricing is the best known rule for pricing services so as to cover overhead, and variants of it have been proposed for regulated rail rates (28). Ramsey pricing sets the following pricing rule:

$$\frac{P_i - C_i}{P_i} = \frac{M}{E_i}$$

where P_i is the price in a given market, C_i is the marginal cost of serving that market, E_i is the price elasticity of demand in the market, and M is the proportionality constant that adjusts markups in all markets to the point at which the firm breaks even (11).

Under the Ramsey rule, markups are higher the less elastic the demand. Thus, shippers with relatively inelastic demands for rail service will contribute more to rail overhead (note that these shippers would not necessarily be better off if rates were raised for more price-sensitive shippers, and if price-sensitive shippers then chose other modes, leaving a larger share of overhead to remaining shippers). The Ramsey rule can also be expressed as follows:

$$M = \frac{P_i - C_i}{P_i} \cdot E_i = \frac{P_j - C_j}{P_j} \cdot E_j, \; j=i.$$

for any pair if markets i and j, the percentage deviations from marginal cost, weighted by the price elasticities of demand, must be equated to the markup M.

Note that the proportionality constant, M, is a regulatory decision. Otherwise, Ramsey pricing rules are standard monopoly profit maximization rules. Regulations impose a profit constraint by specifying a value for M. Ramsey prices are then effective means of allocating overhead.

Implementing Ramsey pricing rules can be more complicated than the above example implies, because marginal costs may not be constant and demands may be interdependent. In each case, the pricing rule becomes considerably more complicated (11). The rule requires that the

regulator (or the firm) have information on price elasticities of demand. Such information may be unreliable. The spirit of the Staggers Act allows railroads wide freedom to set rates, given some regulatory constraints in monopoly markets as expressed in the proportionality constant M. Therefore, regulators have been prone to delegate the practical difficulties of setting the pricing rules to the railroads. The fundamental difficulty concerns the specification of the proportionality constant. In principle, M reflects the constraint on monopoly profits imposed by regulation. When imposing a constraint, the ICC faces the difficult public utility regulatory problem of determining company profits, which entails estimation of a rate base, or the value of railroad capital. The Staggers Act directs the ICC to impose rate regulation on monopoly markets (that is, to set the constraint M) only if railroads are "revenue adequate," which means only if rates of return on railroad capital exceed the competitive rate of return. The ICC has found no railroad to be revenue adequate, and a recent statistical analysis finds that railroad profits are still well below competitive levels (39). Critics argue that the relevant rate base, railroad capital stock, is overestimated, leading to underestimates of the profit rate (41). They say that rail regulation forced railroads to maintain many nonviable lines.

Since deregulation, the revenue on these lines still exceeds marginal operating costs, so the lines will continue to run for a relatively long time. In short, critics argue that the rail network, and the relevant rate base, will be far smaller in the future and that current profit rates will be poor proxies for future profits on viable lines. In this view, past decisions to retain nonviable lines impose income losses on the current system, and the regulatory issue concerns the identity of the group that will bear the losses. If the relevant rate base (the value of railroad capital stock) is actually inflated then the losses will be imposed on captive shippers. If railroad capital stock values are not above their true longrun values, then the deflation of stock values and the imposition of profit constraints will raise costs of rail capital and impose losses (through lower allowed rail rates) on railroad stockholders.

Regulators face a difficult problem. Deregulation will probably not be a complete solution to the "railroad problem." Railroad financial problems and captive shipper complaints (often legitimate) will continue to bedevil policymakers and regulators. But, the Staggers Act and associated regulatory reform actions have led to more efficient rail pricing and service and have improved the financial status of railroads.[14] As long as the grain-merchandising industry (elevators and trucks) is competitive, then rail rate declines will be passed through to producers. Deregulation has shifted the focus of regulation to real, if difficult, problems, and has moved regulatory resources away from attempts to regulate competitive markets.

[14] According to the Association of American Railroads, the rate of return on net investment among Class I railroads averaged 3.98 percent in the 5 years after Staggers (1981-85), compared with 1.71 percent in the 5 years before Staggers. Little change occurred in the Southern District over those post-Staggers years, while large improvements occurred in the Eastern and modest increases in the Western District. The improvements in reported profits actually began around 1978 and 1979 and are probably associated with the bankruptcy of the weakest eastern and midwestern roads and the acceleration of abandonments in the 1970's. The profit improvements followed from the general set of regulatory reform events in the 1970's that were capped by Staggers, and not solely from new rules introduced in the Staggers Act.

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